This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

HARVARD UNIVERSITY

LIBRARY

OF THE

PEABODY MUSEUM OF AMERICAN ARCHAEOLOGY AND ETHNOLOGY

IN EXCHANGE WITH

The Academy

Received December 24, 1907

Proceedings

—— OF THE ——

Davenport Academy of Sciences

VOLUME XI.

Published from the Income of the
Putnam Memorial Fund

DAVENPORT, IOWA, U. S. A.
DAVENPORT ACADEMY OF SCIENCES
1910

PUBLICATION COMMITTEE—1910.

ELIZABETH D. PUTNAM, Chairman.

C. H. PRESTON. J. H. PAARMANN.

SAMUEL CALVIN. A. D. FICKE.

E. K. PUTNAM, Acting Editor.

The authors of the various papers are alone responsible for what is contained in them. The date of printing each form is given in the signature line.

PREFACE.

With the present volume the Davenport Academy of Sciences has changed the method of publication of its PROCEEDINGS. To avoid the delay incident to waiting for volumes to be completed, and to make less likely the burying valuable papers in a general volume, the separate papers are now distributed in pamphlet form as soon as printed. Ordinarily the last section of each volume will contain reports of officers and a record of Academy meetings, together with title page for the volume, table of contents, and index. This plan makes possible the binding of the volumes of the PROCEEDINGS by those libraries and societies that wish to keep their file intact. On the other hand there will be a more prompt and direct distribution of the separate papers to those who are most interested.

In the case of the present volume the record of the meetings, etc., is omitted, as the last section of Volume XII, soon to be printed, will bring the record from 1907 down to date. The present volume also does not contain an index, as each of the two papers constituting the volume is supplied with an individual index, that for Edmundson's Protozoa of Iowa being found at pages 121 to 123, and that for Anderson's Birds of Iowa at pages 408 to 417.

THE PUBLICATION COMMITTEE.

DAVENPORT, IOWA,
December, 1910.

TABLE OF CONTENTS.

Page

Preface iii
Table of contents v
List of illustrations vi
The Protozoa of Iowa. By Charles Howard Edmundson. 1
Index to the same. 121
The Birds of Iowa. By Rudolph M. Anderson 125
Index to the same 408
Errata to the same 407, 417

LIST OF ILLUSTRATIONS.

Edmundson: The Protozoa of Iowa.
Plates I to XXX . . . . . Following page 124
Anderson: The Birds of Iowa.
Map of Iowa, showing boundaries of life zones and glacial drift areas, and stations from which reports were received. Facing page 125

SEPTEMBER, 1906 VOL. XI. PAGES 1-124

Proceedings

—OF THE—

Davenport Academy of Sciences

THE PROTOZOA OF IOWA

BY CHARLES HOWARD EDMONDSON

Published from the Income of the
Putnam Memorial Fund

DAVENPORT, IOWA, U. S. A.
DAVENPORT ACADEMY OF SCIENCES
1906

PROCEEDINGS OF THE DAVENPORT ACADEMY OF SCIENCES

Davenport, Iowa, September, 1906 Vol. XI, Pages 1-124

THE PROTOZOA OF IOWA.

A STUDY OF SPECIES KNOWN TO OCCUR IN THE WATERS OF THIS STATE

By CHARLES HOWARD EDMONDSON.

A THESIS

Submitted to the Faculty of the Graduate College of the State University of Iowa for the Degree of Doctor of Philosophy.

INTRODUCTION.

To the zoölogist the Protozoa which swarm the seas and are found abundantly in inland rivers, lakes, ponds and pools, adapting themselves to nearly every condition of moisture, offer an interesting and fruitful field for investigation.

The one-celled animals concern the student of Nature not only because of their position in the scale of animal life; not only by reason of their economic value both positive and negative, but also because many of the phenomena exhibited by highly specialized life can be explained only by a knowledge of the characteristics and behavior of these lowly organisms.

Although discovered in 1675 by Leeuwenhoek, the unicellular nature of the Protozoa was not declared with assurance until 1848, but within recent years these one-celled animals have not been unimportant factors in solving puzzling biological problems when subjected to skilful and patient experimental work. Especially have the Protozoa been a means of advancing the knowledge concerning the animal cell by the careful labor of many devoted students of science, and as a result of the concentration of attention upon the simplest of microscopic animals problems of a diverse and complex character have arisen. There is some

reason to believe, in the light of recent experimental work, that the psychical is a factor in the behavior at least of the higher forms of unicellular animals; the discovery of the relation of parasitic Protozoa to various diseases has opened up a broadening field for the pathologist, and no doubt, in the future, questions of sanitation involving the Protozoa will arise, as others have already arisen, making a knowledge of the forms which inhabit the sources of common water supplies, their life histories and the means of successfully combatting them essential for the protection of the public health. An acquaintance, therefore, with as many species as possible, their structure and the conditions under which they exist would seem to be quite desirable.

From a purely systematic point of view the one-celled animals of this country have been neglected, only a few workers here and there having devoted a portion of their time toward classifying and working out the life histories of the species in their immediate vicinities.

The purpose of this paper is to furnish a preliminary report on the species of Protozoa to be found in the waters of the state of Iowa. It is an attempt to set forth, in as plain and concise terms as possible, descriptions of species already known which inhabit the waters of this state, also calling attention to certain forms which apparently have been undescribed previous to this time. Drawings of the species observed have been made either from the living specimens or from permanent preparations, the former being in most instances preferable and more accurate as even the best of reagents may give to the delicate organisms a distorted and unreal appearance.

The entire state has not been covered in the preparation of this paper although the waters of more than thirty counties comprising the eastern, central, southern and extreme north-western portions of the state have been examined. Observations have been made over wide enough territory for us to conclude that the distribution of Protozoa in this state is quite general. For the most part, species taken from Lake Okoboji were identical with those found in the ponds, pools and small streams of the south-eastern counties of the state and, with few exceptions, species found in other localities of the state have been obtained from the waters of Johnson county where the greater part of the work for this paper

has been done. In some instances individuals of the same species have been found in widely separated regions while the species was not found in intermediate localities. This, however, is not conclusive evidence that the species did not exist in the intervening territory.

Judging from collections of material in various counties, so general seems to be the distribution of Protozoa that it is quite probable that a permanent body of water such as a small lake would, during the different seasons of the year, furnish most of the species that might be obtained from the waters of the entire state.

Although perhaps the most successful group of animals because of their minute size, the nature of their habitat, their power of encystment, rapidity of reproduction and manner of distribution, all forms of fresh water Protozoa do not indiscriminately find a habitat in similar environments. After considerable experience in collecting them one learns to know, with at least some degree of accuracy, the conditions under which species exist. Such knowledge is of some value when certain forms are desired for biological studies. Holotrichous and hypotrichous ciliates are commonly found in stagnant and bacteria-laden water, while the Mastigophora and shell bearing Rhizopods preferring a purer habitat are commonly found among algæ and other plants of low rank. Stalked peritrichous forms may be found in fresh water in running streams or quiet pools, usually attached to stones, sticks, leaves, etc. Vorticella, however, is commonly observed in stagnant pond water. For the most part, suctorians have been found among aquatic plants in fresh water.

Some species are bottom swimmers while others are found at the surface; some seek the shaded places while others are attracted by the light. It should be noted that these are only general habitats and a species may be found in very diverse environments when conditions are correct for its existence.

In making permanent preparations of Protozoa various methods may be employed. Shelled Rhizopods and forms possessing well-defined loricæ may be readily and permanently preserved by allowing them to dry on the slide, then mounting in balsam. Glycerine preparations of many forms of Protozoa may also easily be made by draining off as much water as possible after the organisms are fixed, then applying glycerine, but it is often necessary to nullify

the shrinking effect of the glycerine by a judicious use of acetic acid.

Glycerine-jelly also may be used as a mounting medium, having some advantages over glycerine. Some naked Protozoa of considerable consistency may be fixed in a drop of water, then allowing the water to evaporate, the organisms adhering to the slide may be stained, dehydrated, cleared and mounted in accord with the usual histological methods.

As a general fixing agent the fumes of osmic acid have proved very satisfactory.

In the preparation of this paper the microscopic work, for the most part, was done in the zoölogical laboratory of the State University of Iowa.

To Prof. Nutting, at whose suggestion this report was initiated, I am exceedingly grateful not only for his having placed at my disposal the best facilities afforded by the department of Zoölogy, but also for direction and encouragement in the pursuance of the work.

Profs. Wickham and Houser have also rendered assistance by way of valuable suggestions.

The classification employed in this paper is a combination derived from several sources, following quite closely, however, the scheme of Calkins in his volume, "The Protozoa," this being, it seems to me, a convenient system of grouping. No attempt is made to give a complete table of classification of Protozoa but, for the most part, only those orders and families are included, types of which have been observed or are likely to occur in the waters of this state.

TABLE OF CLASSIFICATION.

Class, SARCODINA.

Protozoa with or without shells, with pseudopodia lobose, finger-like or ray-like and sometimes anastomosing, with or without axial supports.

Sub-class, RHIZOPODA.

With or without shells, with lobose, finger-like or anastomosing pseudopodia.

Sub-class, HELIOZOA.

With or without shells, with ray-like pseudopodia usually with axial supports.

Sub-class, RADIOLARIA.

With or without a skeleton but with an internal capsule. Pseudopodia ray-like. Marine forms comprising over 4,000 species, according to Haeckel.

In this work on fresh water forms no further classification of this group will be given.

Orders of Rhizopoda.

AMŒBIDA.

With or without shells, with lobose pseudopodia.

RETICULARIIDA.

With or without shells, with finely branching and anastomosing pseudopodia. Shells usually calcareous. Mostly marine forms.

Orders of Heliozoa.

APHROTHORACIDA.

Without shells, with ray-like pseudopodia, sometimes with axial supports.

CHLAMYDOPHORIDA.

With a gelatinous or fibrous coating.

CHALARATHORACIDA.

With an outer covering of separate silicious spicules.

DESMOTHORACIDA.

With a perforated shell, sometimes stalked.

FAMILIES AND GENERA OF AMŒBIDA.

AMŒBIDÆ.

Without shells. Pseudopodia lobose or sharp-pointed, sometimes branched.

Amœba Ehr.

Dinamœba H. & L.

**Hyalodiscus* H. & L.

Round or disc-shaped, moving without distinct pseudopodia.

**Pelomyxa* Greeff.

Broad lobe-like pseudopodia, many nuclei.

ARCELLIDÆ.

With membranous shells with which may be incorporated foreign materials. Pseudopodia lobose or short-pointed, often branched.

Difflugia Leclerc.

Arcella Stein.

Centropyxis Stein.

Cochliopodium H. & L.

Pamphagus Bailey.

**Hyalosphenia* Stein.

Shell flattened, pyriform, aperture terminal, pseudopodia finger-like.

**Quadrula* Schultze.

Shell of square plates of chitin, flattened pyriform, pseudopodia finger-like.

**Nebela* Leidy.

Shell of chitinous plates of variable shapes and sizes often intermingled with foreign materials. Pseudopodia as in *Quadrula*.

EUGLYPHIDÆ.

Shells of plates of chitin or silica, sometimes spined. Pseudopodia sharp-pointed, often branched but not anastomosing.

Cyphoderia Schlum.

Euglypha Ehr.

Assulina Duj.

Trinema Duj.

**Campascus* Leidy.

Shell as in *Cyphoderia* but with lateral processes on the fundus. Pseudopodia delicate and branched.

Families and Genera of Reticulariida.

Gromidæ.

Shell sac-like, membranous. Pseudopodia extending from an opening in one end of the shell, long, branching and anastomosing.

Fresh water forms of the order are most likely to belong to this family, therefore it is introduced here.

**Gromia* Duj.

Pseudopodia forming a network about the shell.

**Microgromia* Hertwig.

Shell flask-shaped, not filled by the body. Often forming colonies.

**Pseudodifflugia* Schlum.

Shell chitinous, to which foreign materials are added. Pseudopodia delicate and branched.

Genera of Aphrothoracida.

Note.—Family names have not generally been used in the classification of Heliozoa.

Vampyrella Cienk.

Actinophrys Ehr.

Actinosphærium Stein.

Genera of Chlamydophorida.

**Heterophrys* Archer.

With fine radiating spines between the pseudopodia. (?)

**Sphærastrum* Greeff.

Outer surface lobe-like. Sometimes forming colonies.

GENERA OF CHALARATHORACIDA.

Raphidiophrys Archer.

**Acanthocystis* Carter.

With two kinds of rays: silicious rays with branched ends and delicate pointed rays as in *Actinophrys*.

GENERA OF DESMOTHORACIDA.

Clathrulina Cienk.

NOTE.—Species of genera marked with the asterisk (*) in the above table of classification have not, so far, been observed in this state.

Class, SARCODINA.
Sub-class, RHIZOPODA.
Order, AMŒBIDA.
Family, AMŒBIDÆ.

AMŒBA Ehrenberg.

With homogenous ectoplasm and more granular endoplasm. Pseudopodia lobose, finger-like or pointed. Endoplasm enclosing nucleus, contractile vesicles and inclusions.

AMŒBA PROTEUS Leidy.

Body of large size. Pseudopodia finger-like, or lobose. (Fig. 1, Pl. I.)

Amœba proteus, the first Rhizopod in point of time to come under the observation of the microscopist, is one of the most common and widely distributed.

In 1775 Rösel described this species, but it was the science of more recent times that demonstrated the minute particle of protoplasm to have the essential characters of a single living cell and to be the physiological source of specialized functions.

Various characteristics render *Amœba proteus* a most desirable subject for biological studies: it is the largest and most common species of the genus and can easily be obtained, at least in limited quantities; the differentiation between ectoplasm and endoplasm is usually well marked, the normal activity of the organism permitting the formation of pseudopodia to be readily observed,

while the simplicity of the structure reminds the thoughtful student that before his eyes is life reduced to its lowest terms.

In the formation of pseudopodia the ectoplasm is thrust out in digitate processes from various points of the periphery, to be closely followed by the granular endoylasm in a streaming movement.

Bütschli, and more recently Rhumbler, announced that as the endoplasm advances in a median axis toward the end of the newly formed pseudopodium, it flows outward and streams back along the inner surface before coming to rest. That such a backward flow does not take place has been clearly demonstrated by Jennings, the results of his observations being recorded in the sixth paper of "Contributions to the Study of the Behavior of the Lower Organisms." The cause for the formation of pseudopodia has been attributed by Verworn to the introduction of oxygen into the molecules at the surface of the body thereby reducing cohesion, the result being that surface tension is reduced. This observation is of no little significance from a biological point of view as it is believed that highly specialized muscular movements are but modifications of such a movement as is expressed in the pseudopodium of *Amœba*.

There are no fixed distinctions between the regions of *Amœba proteus*, but at times what may be termed an anterior and posterior differentiation is observed, the anterior region being the one from which pseudopodia are extended, the posterior, the part of the body following and flowing into the advancing pseudopodia.

Diatoms and other unicellular plants are the chief food of *Amœba proteus*. Ingestion of solid food particles by their being enclosed by pseudopodia and simply engulfed by the flowing protoplasm may be a matter of common observation, but the causes which underlie the process are not so clear.

Relative adhesions between the food particle and the water in which it rests on the one hand and the food particle and the protoplasm of the *Amœba* on the other hand are probable factors in the process of iugestion, but it is to be remembered that *Amœba* is a living cell, a cell in which chemical changes take place rapidly and choice of food exhibited by it, no doubt, depends upon physiological states of its protoplasm.

Although generally distributed and found almost everwhere in both stagnant infusions and fresh water *Amœba proteus* is an

isolated form, seldom being found in aggregated quantities. The common habitat is pond water in the ooze on submerged leaves, sticks, etc., but the species is sometimes found in fresh water among algæ and diatoms.

Usually a single nucleus is present, but often more than one contractile vesicle; neither nucleus nor vesicles are, however, constant in position due to the streaming movements of protoplasm. Reproduction takes place by simple cell division.

In size the individuals vary greatly. Many observed in this state have reached a length of 250 microns while other workers have reported individuals of much larger dimensions.

AMŒBA RADIOSA Ehr.

Body a spherical mass from which radiate two or more long, slender, pointed pseudopodia. (Fig. 3, Pl. I.)

If the species previously described is characterized by activity, *Amœba radiosa* should be characterized by inactivity. Stellate in its general appearance, the organism usually rests motionless in the water with its ray-like pseudopodia as rigid as though it possessed no power of contractibility whatever. If patient in observation, however, one may occasionally see a pseudopodium slowly contract and a new one extend itself from the body.

The rays may reach a length twice the diameter of the body, are flexible and may be bent from side to side without causing them to be withdrawn.

A peculiar movement of the organism has been observed to take place. After resting motionless for some time the form may turn itself over in the water and suddenly spring backward as though under the impulse of some violent stimulus. The cause for such behavior has not been determined.

The distribution and habitat of *Amœba radiosa* is very similar to that of *Amœba proteus*. In size, this species is the smallest of the genus and exceedingly variable. The diameter of the body of some individuals observed in this state has reached 45 microns.

AMŒBA VILLOSA Wallich.

Body, when active, palmate in shape, usually differentiated into a broad anterior and narrow posterior region, the latter produced into a rounded knob-like area, the surface of which presents a villous appearance. (Fig. 2, Pl. I.)

In size this species is almost as large as *Amœba proteus*, differing from the last named species, however, in possessing rather well defined anterior and posterior extremities. The species is usually remarkably active, progressing with rapidity in a definite direction by a forward rolling motion, the broad end preceding.

Pseudopodia, when they make their appearance, which is seldom, are broad and lobe-like. The villous appearance of the knob-like posterior extremity, which characterizes the species, is probably due to a rapid shrinking away of the protoplasm of this region as the animal rolls forward in its customary movement

In appearance *Amœba villosa* is light yellowish, the endoplasm usually being crowded with food materials consisting of diatoms, algæ, etc. A nucleus and a contractile vesicle are present, the former, however, often being obscured and not observed without the use of reagents.

This species has been obtained in great numbers from the sediment at the bottom of a long standing infusion of pond water.

I have not observed the species in this state except in Johnson county, although no doubt its distribution is general.

Length, reported by Wallich, 1-50th of an inch. Specimens observed in this state, about 200 microns in length.

AMŒBA VERRUCOSA Ehr.

Body usually rounded, very transparent. Pseudopodia short, broad, blunt. Ectoplasm extensive in comparison with the more granular endoplasm. Upper surface usually wrinkled, giving the appearance of longitudinal lines.

Length, 50 microns. (Fig. 4, Pl. I.)

Amœba verrucosa, in the adult stage, is a very sluggish form, its chief movement being a slow, rolling motion, while short, lobe-like pseudopodia may be slowly extended. Immature individuals are much more active, moving with a broad extremity in advance.

The longitudinal wrinkles, of which there are usually four extending from the posterior nearly to the anterior extremity, seem to be but temporary folds of the ectoplasm. They are not at all times constant in number in the same individual and, in some, not appearing at all.

Amœba verrucosa is apparently neither abundant nor widely distributed in this state. The few individuals observed have been found in diatomaceous ooze from pond water.

DINAMŒBA Leidy.

Amœba-like, oval or elongate when active. Pseudopodia usually many. Posterior region with or without short, blunt papillæ. Body often surrounded by a zone of transparent protoplasm. Spicules present.

DINAMŒBA MIRABILIS Leidy.

Body somewhat resembling *Amœba proteus* but more regular in outline. Pseudopodia very numerous, long, finger-like, with or without minute lateral processes.

Length, as observed, 200 microns. (Fig. 5, Pl. I.)

When active, this organism extends pseudopodia from all parts of the periphery and often the body is surrounded by a broad layer of hyaline protoplasm through which the pseudopodia protrude for a considerable distance. This external layer is often marked by myriads of minute spicules which give it a striated appearance, the striæ being parallel to the long axis of the pseudopodia. The spicules may or may not be found on the extended pseudopodia. In the forms coming under my observation the posterior papillæ were usually entirely absent.

Dinamœba mirabilis is found in pond water. It feeds upon algæ, diatoms, etc., the endoplasm often being densely packed with these organisms.

Family, ARCELLIDÆ.

DIFFLUGIA Leclerc.

Body protected by a shell which is composed largely of foreign particles, commonly fine quartz sand. Mouth usually terminal, from which may be extended long, cylindrical pseudopodia, either simple or branched.

Nine species have been found in the waters of this state.

DIFFLUGIA PYRIFORMIS Perty.

Shell oval or pear-shaped, sometimes with a short neck and broadly expanded fundus with or without spines, composed mainly of sand grains. Pseudopodia slender, cylindrical, simple or branched.

Length of shell, from 50 to 300 microns.

This species is a common one and many varieties of shells must be included in it.

Figure 9, Plate II, represents a typical form of the spined variety, also possessing branched pseudopodia.

Figure 12, Plate II, is a spineless variety having a deep annulation not far from the mouth. It has been found in great abundance in Dickinson county and in other localities.

Figure 8, Plate II, illustrates a very minute variety which is frequently observed in the process of conjugation.

Difflugia pyriformis is widely distributed, found in fresh water among algæ, and usually in an active state.

During the summer of 1905 many individuals were found having the protoplasm bright green in color, due probably to previously ingested plant tissue, upon which the species ravenously feeds. The pseudopodia being adhesive are enabled to draw into the mouth such food particles as may cling to them.

Reproduction takes place, as in the other species of the genus, by the extrusion of a portion of the cell-mass and the formation of a new shell about the extruded portion, after which the two individuals separate.

DIFFLUGIA GLOBULOSA Duj.

Shell more or less spheroidal in shape, composed usually of quartz sand. Mouth large, terminal, seldom with a well-marked neck.

Length, 100 microns. (Figs. 6–7, Pl. II.)

This is one of the smallest and rarest species of the genus. All of the forms observed in this state were of the spheroidal shape represented by Fig. 6, Pl. II, with the mouth truncating the oral extremity. The fundus is usually evenly rounded, bearing no spines. The mouth, as shown by Fig. 7, Pl. II, is large, round, and without lobes.

The habitat of this species is similar to that of the other members of the genus, but seldom does one observe active individuals. Specimens were taken from Lake Okoboji during the summer of 1905, and also from the waters of Johnson county.

DIFFLUGIA CRATERA Leidy.

Shell usually of small size with an oval or rounded fundus prolonged anteriorly into a broad cylindrical neck. Mouth terminal.

Length, from 55–150 microns. (Figs. 14–15, Pl. II.)

This species is also a rare one and seldom is it found in an active condition. Fig. 14 represents the most common variety found in this state, having a rounded fundus and broad, flaring neck. Fig. 15 illustrates a curious variety found in Johnson county, having an exceedingly long neck terminating in a flaring rim. Between the distal end of the neck and the body proper were two other annular ridges, giving the appearance of a once completed shell with later additions.

Found in pond water among diatoms and other plants of low order.

DIFFLUGIA CONSTRICTA Leidy.

Shell oval in form with the anterior border obliquely truncate, composed of sand grains and other foreign materials. Fundus rounded, with or without spines.

Length, 100 microns. (Fig. 17, Pl. III.)

Rarely has this species been found in the waters of this state. Fig. 17, Pl. III, illustrates a typical form of the species as observed in Johnson county. These specimens were small individuals, as Leidy reports that only the larger varieties bear spines. None of those which I have observed possessed spines. In disposition the organism is shy, seldom extending pseudopodia.

The size of the shell, according to Leidy, may range from about 90 to 200 microns in length. Those observed in this state were approximately 100 microns in length.

DIFFLUGIA ACUMINATA Ehr.

Shell usually composed of sand crystals, oblong-oval in shape, the fundus prolonged into an elongated process more or less acuminate; no spines.

This species has a wide distribution and has been found in almost every locality of the state where I have made an examination of the waters.

Figure 13, Plate II, represents a typical form of *Difflugia acuminata*, although great variations may occur in the size and shape of the shells. The posterior acuminate process, although a characteristic of this species, may be possessed by other species. I have observed it in *Difflugia urceolata*, and an approach to it in *Difflugia cratera*. Intergrading forms are not uncommon, having characters of more than one species.

Difflugia acuminata is often found associated with *Difflugia pyriformis* in fresh water and is also in the ooze at the bottom of lakes, ponds, etc.

Length of the individual represented by Fig. 13, Pl. II, 175 microns.

DIFFLUGIA URCEOLATA Carter.

Shell of large size, fundus usually evenly rounded, seldom spined; neck short; mouth large, circular, surrounded by a reflected rim with a thin edge; pseudopodia as in *Difflugia pyriformis.*

Length, 250-300 microns. (Fig. 19, Pl. III.)

In size this is the largest species of the genus. Its distribution over the state is, apparently, not very general, few localities having furnished it. The best specimens have been obtained from pond water in Muscatine county. Lake Okoboji, from which, in August, 1905, were taken great quantities of other species of *Difflugia*, furnished none of *Difflugia urceolata.*

Prof. Leidy reports a spined variety of this species from New Jersey. None of the forms found in this state were spined. Fig. 19, Pl. III, represents a variety of *Difflugia urceolata* which is typical except for the possession of the posterior acuminate process which, however, would hardly be considered a spine.

Pseudopodia are of the common digitate variety, rarely being branched.

DIFFLUGIA LOBOSTOMA Leidy.

Shell small, oval, usually composed of fine sand grains; mouth terminal, small, with three or four well-marked lobes; pseudopodia as in other members of the genus.

Length, 95 microns. (Figs. 10–11, Pl. II.)

Figure 10, Plate II, illustrates a typical form of *Difflugia lobostoma* as it is usually observed resting on the water.

Figure 11, Plate II, is an oral view of an individual of the same genus, showing the lobed nature of the mouth. The species is a very common one in pond water and has a wide distribution, being found in many localities in this state.

Normally the organism rests upon its side, but by turning it so that the mouth is visible it may easily be determined whether or not it meets the requirements of this species.

Those possessing the three-lobed mouth are the most common forms of this state.

DIFFLUGIA CORONA Wallich.

Shell spheroidal, composed of particles of quartz sand, the fundus usually being spined. Mouth terminal, circular, with a notched border.

Length, 175 microns. (Fig. 16, Pl. III.)

Difflugia corona is one of the larger species of the genus. The distribution is general, being found in great abundance in many localities in the state. Lake Okoboji, during the summer of 1905, furnished myriads of this species. Commonly *Difflugia corona* may be found resting with its mouth downward while the cylindrical pseudopodia protrude in a radiating manner.

The small tooth-like processes bordering the mouth may vary in number but are usually more than ten. The number of spines also varies, but seldom less than four or five to an individual have been observed. Frequently found among algæ.

DIFFLUGIA SPIRALIS Ehr.

Shell retort-shaped with an evenly rounded fundus, laterally compressed. A short neck usually produced.

Length, 125 microns. (Fig. 18, Pl. III.)

This species is a rare one in this state, having been found but a few times and only in Johnson county.

The spiral appearance of the shell is due to an interior partition arising from the concavity of the side of the body and extending to an upward curve toward the other side. This partition does not entirely separate the cavity but serves as a wall, behind which the protoplasm may retract. When viewed through the more or less transparent shell the partition resembles a dark line.

Found in pond water among aquatic plants.

ARCELLA Ehrenberg.

Body secreting a shell of chitinoid material, semi-spheroidal in shape when viewed laterally, usually circular when viewed dorsally or ventrally; mouth central; pseudopodia digitate or broadly lobate, never branched. Nuclei and contractile vesicles usually more than one.

ARCELLA VULGARIS Ehr.

Shell usually some shade of yellow or brown, about one-half as high as broad, the character of the surface varied. Mouth circular, in the center of the ventral surface.

Diameter of shell, 75 microns.

Arcella vulgaris is one of the most common of fresh-water Rhizopods, being found nearly everywhere in small streams, lakes and ponds.

The shell varies in color from pale yellow, which indicates a young individual, to dark brown, indicating advanced age. The species also varies greatly in the character of the markings of its surface; commonly the shell presents a cancellated appearance, the punctæ being arranged with regularity. In older individuals, however, this character may disappear and no trace of the punctæ be found. Sometimes the convex surface is ornamented by shallow concavities arranged with more or less regularity.

Other markings of the surface may also occur.

Figure 20, Plate III, illustrates a common variety, the punctæ, however, not appearing in this individual. Fig. 21 shows a somewhat rarer variety, the surface being marked with shallow concavities.

Conjugation has often been observed to take place by the temporary union of the ventral surfaces of the two individuals, as represented by Fig. 22. During the fall of 1903 many individuals taken from the pond water in Johnson county were seen to undergo reproduction, a portion of the protoplasmic mass first being pushed out from the individual's mouth and resting upon it in spherical form, yet connected with the protoplasm within the shell. (See Fig. 23, Pl. IV.)

From the extruded portion another shell is secreted, very transparent at first, the two individuals finally separating. Fig. 24 represents an advanced stage in the process, the shells to the left and right being the mother and daughter *Arcella* respectively, the latter drawing into itself a sufficient quantity of protoplasm before separating from the parent.

Sometimes compact masses comprising a score or more of individuals of this species may be seen adhering to each other, floating in the water.

In members of this genus the protoplasmic body of the individ-

ual does not completely fill the shell but is attached to the inner surface by means of minute threads. By the liberation of carbon dioxide within the shell, at any point, the organism has the power to change its position in the water at will by changing its specific gravity; thus the species may raise itself in the water or turn on its side. At least two nuclei are usually present, opposite in position. Contractile vesicles may be numerous.

ARCELLA DISCOIDES Ehr.

Shell comparatively large, flattened, disc-like. Mouth circular and of large diameter.

Diameter of shell, 125 microns. (Figs. 25–26, Pl. IV.)

This species differs from the preceding one in three particulars: the diameter of the shell, the height of the dome, and the diameter of the mouth.

The height of *Arcella discoides* is frequently less than one-fourth its diameter and the diameter of the mouth often equals one-half the diameter of the shell.

Figure 26, Plate IV, represents a typical form of this species from a lateral point of view. Fig. 25 is a dorsal view showing extended pseudopodia.

The surface of *Arcella discoides* is usually marked by punctæ but no shallow concavities have been observed as in the case of *Arcella vulgaris*.

Although widely distributed the individuals are usually isolated, not appearing in aggregate quantities. A few specimens have been observed in many localities of this state. Found in pond water among aquatic plants and often associated with *Difflugia*.

CENTROPYXIS Stein.

Shell composed of chitinous material with the addition of sand grains, diatom shells, etc.; ovoid in shape with the mouth and fundus eccentric in opposite directions. Spines usually present.

CENTROPYXIS ACULEATA Stein.

Having the characters of the genus.

Length of shell, 150 microns.

Diameter of mouth, 60 microns. (Figs. 27–28, Pl. IV.)

Centropyxis may be considered as an intermediate form between *Arcella* and *Difflugia*, resembling the latter, however, more than the former. The appearance of *Centropyxis* is as if *Difflugia* were compressed dorso-ventrally and laterally, resulting in the eccentricity of the mouth and fundus. Of the foreign material making up the shell quartz sand predominates, thus giving to the organism the external appearance of *Difflugia*, its coloration, however, usually being some shade of brown.

The fundus is often provided with spines which are longer and more slender than those of *Difflugia* and which are seldom with any addition of foreign material.

From one to six or eight spines are usually present. A spineless variety has been observed on a few occasions in this state.

Centropyxis is noted for its shyness. Only once have I found the species in an active condition. Fig. 28 illustrates a lateral view of the active individual with a single, long, cylindrical pseudopodium extended. Fig. 27 is a ventral view of a spined form.

Centropyxis aculeata is widely distributed over the state, frequently found in great numbers among algæ.

COCHLIOPODIUM Hertwig and Lesser.

Shell a delicate, transparent membrane, exceedingly flexible. Protoplasm granular and in close contact with the inner surface of the shell. Mouth capable of becoming greatly expanded as its borders are reflexed.

COCHLIOPODIUM BILIMBOSUM Leidy.

Body with the characters of the genus but having no hair-like appendages. Endoplasm colorless.

Diameter of shell, 60-90 microns. (Fig. 29, Pl. V.)

This minute organism, in general appearance, somewhat resembles *Amœba*, and Auerbach first described it as belonging to that genus. The shell is very plastic and corresponds to the amœboid movements of which the animal is capable.

When viewed from above sometimes the body seems to be surrounded by a zone of exuded protoplasm, this apppearance, however, being due to the great reflection of that region of the shell bordering the mouth. This great expanse of the mouth may be observed when the organism is viewed laterally, the membranous shell then appearing as a double contour line bordering the body.

The pseudopodia are transparent, variable in length, sharp pointed and may be branched or not but do not anastomose. A large spherical nucleus is present but usually not visible without the aid of reagents.

Sometimes found in great abundance in pond water among diatoms, upon which it feeds.

Cochliopodium vestitum, differing from the above species chiefly in the shell being covered with rigid cilia and in the green color of the endoplasm, probably also appears in this state but has not so far been observed.

PAMPHAGUS Bailey.

Body enclosed within a transparent, elastic membrane. Endoplasm completely filling the membrane, more or less granular. Mouth small, terminal. Pseudopodia long, delicate, branching but not anastomosing.

PAMPHAGUS MUTABILIS Bailey.

Body ovoid in shape, seldom changing form, the oral extremity more acutely rounded than the fundus. Mouth small, often indicated only by the region from which the long, delicate pseudopodia are extended. Nucleus large, spherical.

Length, 60 microns. (Fig. 32, Pl. V.)

This organism is not common in the waters of this state, but it is very active, usually being found with its long branching pseudopodia widely extended.

The closely investing covering of the body prevents any great distortion, although slight changes of form sometimes occur. As a result of stimuli the organism withdraws its pseudopodia and assumes a rounded or spherical form.

Pamphagus, no doubt, represents a development of *Amœba* to such an extent that the ectoplasm has become differentiated to form a resisting membrane. The plate figure represents an individual taken from a running stream near Iowa City in December, 1905. Found in the ooze at the bottom of ponds, rivers and lakes.

Family, EUGLYPHIDÆ.

CYPHODERIA Schlumberger.

Shell composed of chitinous material, curved backward from the mouth, retort-shaped. Pseudopodia delicate and branching.

CYPHODERIA AMPULLA Leidy.

Shell composed of minute hexagonal plates, often punctate, and arranged in oblique rows. Fundus evenly rounded or produced into a conical process.

Length, 160 microns. (Fig. 35, Pl. V.)

The color of *Cyphoderia* is usually some shade of yellow or brown, as in *Arcella*, age being indicated by the density and opaqueness of the shell.

In some individuals of dark brown color no indications of the hexagonal form of the plates which compose the shell are to be seen. The surface, as in *Arcella*, is curiously ornamented with punctæ which are usually arranged with regularity.

Leidy reports that the pseudopodia are very delicate, branching but not anastomosing.

The species is exceedingly rare in this state, and no active individuals were among those found.

Habitat, the ooze at the bottom of rivers, lakes and ponds.

EUGLYPHA Dujardin.

Shell chitinous, transparent, composed of plates arranged in longitudinal rows overlapping each other. Usually oblong-oval, circular in transverse sections. Fundus broadly rounded, often bearing spines. Mouth truncating the narrow extremity, with serrated border. Pseudopodia delicate, simple or branched.

EUGLYPHA ALVEOLATA Duj.

Shell composed of oval plates overlapping each other and arranged in regular rows producing the appearance of hexagonal areas. Spines often present.

Length of shell, 100 microns. (Fig. 31, Pl. V.)

Euglypha alveolata is a common Rhizopod, being found almost everywhere in fresh water among algæ or in the ooze at the bottom of ponds and lakes.

The spines when present are long, slender and often curved, usually scattered over the surface of the shell. Spineless forms, however, have been much more common in this state than spined ones. Often the demarkation of the plates is indistinct, the shell appearing as a homogenous structure.

The species is shy in disposition, active individuals seldom

being observed. Fig. 31 illustrates a spineless variety with pseudopodia almost withdrawn.

ASSULINA Ehrenberg.

Shell of chitinous material, oval in shape, compressed, usually made up of hexagonal plates. Mouth truncating the oral extremity, elliptical, with uneven edges. Pseudopodia as in *Euglypha*.

ASSULINA SEMINULUM Leidy.

Having the characters of the genus.

Length, 40 microns. (Fig. 30, Pl. V.)

The shell ranges in color from transparency to dark brown, probably depending upon the age. The hexagonal plates are arranged in alternating rows and about the oral aperture are placed so as to give a notched appearance to the border.

Pseudopodia are exceedingly delicate and transparent, branched but not anastomosing.

The species is apparently a rare form in the state, but few specimens having been found. Seldom may one see the organism with its pseudopodia extended. Its habitat is the ooze at the bottom of ponds.

TRINĖMA Dujardin.

Body enclosed within an elongated, chitinous shell; fundus rounded, oral extremity narrower and obliquely truncate. Mouth circular, sub-terminal, in the center of the truncated border. Pseudopodia very delicate and transparent.

TRINEMA ENCHELYS Leidy.

Having the characters of the genus.

Length, 40 microns. (Figs. 33–34, Pl. V.)

Usually the shell of *Trinema enchelys* presents a homogeneous appearance with a smooth outline, but in some specimens the shells show evidence of being made up of minute oval plates.

In size the species varies greatly, as also in the density of the material composing the shell. Some are transparent while others are completely opaque.

Figure 33, Plate V, represents a form of the apparently homogeneous variety, it being a ventral view. Fig. 34 represents the same form from a lateral point of view.

Trinema enchelys is one of the smallest and most abundant of fresh water Rhizopods. Its distribution is wide, being found in many localities of this state. It is commonly found in the ooze at the bottom of ponds and among diatoms and algæ.

Sub-class, HELIOZOA.
Order, APHROTHORACIDA.

ACTINOPHRYS Ehrenberg.

Body a spherical mass of granular protoplasm from which radiate delicate, tapering, ray-like pseudopodia. Nucleus and contractile vesicles conspicuous.

ACTINOPHRYS SOL Ehr.

Body of granular protoplasm, without chlorophyl. Diameter of body, 100 microns. (Fig. 36, Pl. V.)

The normal appearance of *Actinophrys sol* as it rests in the water is a spherical mass of highly vesicular protoplasm with its ray-like pseudopodia in an active state of extension and retraction.

Among the many vesicles one or more are contractile. Before bursting the contractile vesicle or vesicles rise to the surface, push out the periphery as large, semi-spherical, transparent globules and then suddenly collapse.

The nucleus is large, spherical, central in position and may or may not be visible without the aid of reagents.

Reproduction may frequently be seen to take place by simple fission, a constriction of the body mass occurring and the two portions drawing apart.

The species has been found in great abundance in spring water in the vicinity of Iowa City, but also may be found in more stagnant pond water.

Its distribution is very general.

ACTINOPHRYS PICTA Leidy.

Protoplasm of body as in *Actinophrys sol*, but bright green in color due to the presence of chlorophyl. Diameter of body approximately that of *Actinophrys sol*.

Many forms of the above description have been found in spring water near Iowa City associated with *Actinophrys sol*. In size and

general appearance, except for the green color, they are identical with the last species.

It seems not at all improbable that the green forms observed in this state as well as *Actinophrys picta* of Leidy may be but a variety of *Actinophrys sol.*

No illustration of this green variety has been made owing to its close resemblance to *Actinophrys sol.*

ACTINOSPHÆRIUM Stein.

Body spherical, of large size, protoplasm granular, differentiated into an outer highly vesiculated zone and a denser interior region. Pseudopodia with thick bases, tapering, with axial supports. Nuclei many.

ACTINOSPHÆRIUM EICHHORNII Stein.

Having the characters of the genus.

Diameter of the body, 150 microns. (Fig. 41, Pl. VI.)

The body is of granular protoplasm with a well marked and very transparent peripheral region which is highly vesiculated; usually two or more of these vesicles are contractile exhibiting the same phenomena just before systole as the contractile vesicles of *Actinophrys sol.* The large, ray-like pseudopodia possess rigid yet flexible axial supports which originate from the inner surface of the vesiculated border.

The inner and more dense region of the body may be almost completely filled with small spherical nuclei. I have observed individuals possessing more than sixty nuclei.

The species is not a common one in this state but has been found associated with *Actinophrys sol* in fresh water.

Figure 41, Plate VI, illustrates one-half of a typical specimen.

VAMPYRELLA Cienkowsky.

Body spherical, capable of amœboid movements. Pseudopodia of two varieties, capitate and simple, ray-like.

VAMPYRELLA LATERITIA Fres.

Body spherical, granular in appearance, sometimes brick or orange red in color, sometimes colorless. Capitate pseudopodia the more numerous, arising from all points of the periphery.

Diameter of the body, 30 microns. (Figs. 37–38, Pl. VI.)

This rare and remarkable organism has come under my observation but once, the individual being dark granular in appearance, the endoplasm crowded with minute spherical, oil-like globules. Leidy reports that the body of *Vampyrella* may be of a brick or orange-red color.

The peculiar characteristic of the species is that it possesses two varieties of pseudopodia, the more numerous capitate variety, each having a short stem ending in a minute round head. These are usually projected and withdrawn with great rapidity. A few simple pseudopodia like those of *Actinophrys sol* are intermingled with the capitate variety. Normally the organism rests quietly in the water, but if the microscopist is patient some strange phenomena may be observed. Suddenly, as if not pleased with its surroundings, the animal begins to elongate itself, acquiring an oblong-oval form. The capitate pseudopodia are still active, the simple rays at the region of the body now corresponding to the anterior are withdrawn, while those at the opposite extremity begin to vibrate and the organism slowly moves through the water.

Figure 37, Plate VI, illustrates the normal individual at rest. Fig. 38, Pl. VI, represents the organism during its amœboid phase, as observed by the author.

After a period of more or less duration the animal again comes to rest, the spherical shape is assumed and the vibrating pseudopodia become simple and ray-like once more.

Such phenomena as are exhibited by *Vampyrella lateritia*, are, I believe, of no little significance to the biologist. The sudden transformation of pseudopodia into flagella, and vice versa, is a visible example of the close relationship between amœboid and ciliary movements. The cause or causes underlying such phenomena are not easily determined. Wonderful must be the metabolism in this bit of protoplasm to bring about such marvelous physiological changes.

Found in Johnson county, in fresh water, among diatoms and other one-celled plants.

Order, CHALARATHORACIDA.

RAPHIDIOPHRYS Archer.

Body spherical, composed of granular protoplasm, often bright

green in color. A dense zone of tangentially arranged spicules on the periphery. Pseudopodia as in *Actinophrys sol.*

RAPHIDIOPHRYS VIRIDIS Archer.

Found usually in aggregated groups of variable number. Bodies colorless or filled with green chromatophores. Spicules conspicuous and slightly bent.

Diameter of the body, 75 microns. (Fig. 39, Pl. VI.)

What I have considered to be isolated forms of this species have frequently been found in Johnson county, although none at the time of observation were chlorophyl bearing. The presence and arrangement of the peripheral layer of spicules, however, leads me to believe that the organism should be classified here. At times these bacteria-like spicules are tangentially arranged in the investing layer of protoplasm, the body presenting a smooth contour; frequently, however, the spicules are arranged more radially, crossing each other at sharp angles and may be seen extending along the bases of the pseudopodia. The pseudopodia are ray-like, equalling in length the diameter of the body.

Reproduction has often been observed to take place as in *Actinophrys sol.* Found among algæ.

Figure 39, Plate VI, illustrates a specimen from Johnson county.

Order, DESMOTHORACIDA.

CLATHRULINA Cienkowsky.

Body spherical, enclosed within a latticed capsule and attached by a stem. Pseudopodia simple, ray-like.

CLATHRULINA ELEGANS Cienk.

Protoplasm of the body granular, when mature enclosed within a capsule of silicious material, and attached by a thread-like, tubular stem.

Diameter of capsule, 45 microns. (Figs. 40 and 42, Pl. VI.)

This species is one of the most beautiful of fresh water Protozoa. It is, however, a rare form. The latticed shell is a mark of maturity, young forms for a period after separation from the parent cell showing no indication of such a covering.

Pseudopodia which protrude through the irregular shaped openings of the shell are in all respects similar to those of *Actinophrys.*

It has been my privilege to observe the process of the formation of the stem by which *Clathrulina elegans* attaches itself to some support, usually aquatic plants. A naked individual, the result of recent fission, came under observation, swimming freely for a time; then a cone-shaped outpushing of the protoplasm took place on one side, the protoplasm adhering to a particle of plant tissue, and a stem began to develop. After three hours the stem had reached its normal length, which is about one and one-half times the diameter of the body.

Figure 40 illustrates a normal adult individual. Fig. 42 represents an earlier phase in the animal's life.

Found in fresh water among aquatic plants.

TABLE OF CLASSIFICATION.

Class, MASTIGOPHORA.

Small forms of Protozoa provided with one or more flagella. Often forming colonies.

Sub-class, FLAGELLIDIA.

Naked or enclosed by a membrane. One or more flagella arising from or near the anterior end.

Sub-class, DINOFLAGELLIDIA.

Often provided with shells and usually having at least two furrows, one transverse and one vertical. Flagella usually two, one directed around the body and one away from it. Mostly salt water forms.

Sub-class, CYSTOFLAGELLIDIA.

Flagellates of large size, enclosed by a firm membrane. Salt water forms. No further classification of this group is given in this paper.

Orders of FLAGELLIDIA.

MONADIDA.

Small forms, sometimes amœboid, with no distinct mouth. Flagella one or two.

CHOANOFLAGELLIDA.

Flagellum single, about the base of which is developed a membranous collar. Often forming colonies.

HETEROMASTIGIDA.

Flagella two or more, one directed forward. Bodies transparent and often very plastic.

POLYMASTIGIDA.

Flagella often numerous, at the base of which food is ingested, there being no distinct mouth.

EUGLENIDA.

Flagella one or two at the base of which is a mouth. Often possessing chlorophyl.

PHYTOFLAGELLIDA.

Plant-like flagellates with or without color. An indurated membrane or shell sometimes present. Flagella one or more.

Orders of DINOFLAGELLIDIA.

DINIFERIDA.

Body with two transverse furrows. Members of other orders of the sub-class not likely to occur in fresh water.

Families and Genera of Monadida.

Rhizomastigidæ.

With amœboid body capable of forming pseudopodia. One or more flagella. No distinct mouth.

Mastigamœba Schultze.

Acinetactis Stokes.

**Cercobodo* Krass.

Two flagella, one trailing.

**Cercomonas* Duj.

Form changeable but usually pointed behind. Flagellum single.

Heteromonadidæ.

Small, transparent flagellates with one prominent flagellum and one or more smaller ones. Sometimes forming colonies.

Anthophysa Bory d. St. V.

**Monas* Stein.

Body more or less spherical or oval, sometimes attached by the narrow posterior extremity. Not forming colonies.

**Cephalothamnium* Stein.

Body pyriform, anterior border oblique. Forming colonies at the extremities of a branched pedicle.

Families and Genera of Choanoflagellida.

CRASPEDOMONADIDÆ.

Solitary or forming colonies. Individuals, naked, inhabiting loricæ or embedded in a gelatinous mass.

Monosiga Kent.

Codosiga James-Clark.

Families and Genera of Heteromastigida.

BODONIDÆ.

Minute forms with flagella of nearly equal size. No lorica or membranous covering.

Heteromita Duj.

**Phyllomitus* Stein.

Body elongate-oval, mouth prominent. One of the two flagella trailing.

Families and Genera of Polymastigida.

POLYMASTIGIDÆ.

Flagella usually arranged in two groups. Food ingested at the base of each group.

Trepomonas Duj.

**Hexamitus* Duj.

With four anterior vibratile flagella in two groups, and two trailing flagella.

Families and Genera of Euglenida.

EUGLENIDÆ.

Elongated forms usually with a single flagellum. Pigment spot and chlorophyl often developed.

Euglena Ehr.

Phacus Nitzsch.

Chloropeltis Stein.

Cryptoglena Ehr.

Trachelomonas Ehr.

**Eutreptia* Perty.

With two similar flagella, otherwise as *Euglena*.

**Ascoglena* Stein.

Similar to *Euglena* but inhabiting a sessile tubular lorica.

**Colacium* Ehr.

Similar to *Euglena*, free-swimming or attached to a branched pedicle.

ASTASIIDÆ.

Body elongated but plastic with no coloring substance. Flagella one or two.

Astasia Ehr.

Distigma Ehr.

**Menoidium* Perty.

Lunate, flattened. Flagellum single. Endoplasm granular.

**Atractonema* Stein.

Elongated, spindle-shaped. Flagellum single, very long. Pharynx distinct.

PERANEMIDÆ.

Body persistent in shape and plastic. Flagella one or two. Pharynx distinct.

Heteronema Duj.

Petalomonas Duj.

Anisonema Duj.

Entosiphon Stein.

**Zygoselmis* Duj.

Exceedingly plastic, resembling *Astasia* but with two flagella.

NOTOSOLENIDÆ.

Persistent in shape. Flagella two, the trailing one very short. Oral aperture indistinct. Endoplasm colorless.

Notosolenus Stokes.

FAMILIES AND GENERA OF PHYTOFLAGELLIDA.

CHRYSOMONADIDÆ.

Usually enclosed by a gelatinous mass or firm membrane. Flagella one or two. Often enclosing colored pigment bands.

Nephroselmis Stein.

Mallomonas Perty.

**Ochromonas* Wysotzki.

Somewhat pear-shaped but changeable in form. Flagella two, unequal. Yellow chromatophores usually present.

**Microglena* Ehr.

Ovate or elongate, plastic. Flagellum single. Two yellow color bands usually present.

CRYPTOMONADIDÆ.

Never amœboid. Flagella two, very similar, color bands sometimes present.

Chilomonas Ehr.

Cryptomonas Ehr.

**Cyathomonas* From.

Ovoid, flattened laterally. Flagella two, equal. Endoplasm colorless with a row of refracting bodies near the anterior border.

CHLAMYDOMONADIDÆ.

Body enclosed by a rigid, membranous sheath which is perforated for the flagella. Chromatophores present.

Chlamydomonas Ehr.

FAMILIES AND GENERA OF DINIFERIDA.

PERIDINIDÆ.

With or without a shell. The cross-furrow near the middle of the body. The only family represented in fresh water.

**Gymnodinium* Stein.

Cross-furrow encircling the body.

**Glenodinium* Stein.

Membrane enclosing the body thin, with no processes.

**Peridinium* Ehr.

Membranous covering composed of polygonal plates. Processes not highly developed.

NOTE.—In the above classification, with the exception of *Peridinidæ*, only families, representatives of which have been observed to occur in this state, have been included. Species of the genera marked with an asterisk (*) have not so far been observed in this state, but are likely to occur.

Class, MASTIGOPHORA.
Order, MONADIDA.
Family, RHIZOMASTIGIDÆ.

MASTIGAMŒBA Schultze.

Very plastic and changeable in form. Pseudopodia often extended from the body, bluntly rounded, finger-like or pointed,

sometimes branched. A single flagellum arising from the anterior extremity.

MASTIGAMŒBA sp.

Body elongated, wider posteriorly. Pseudopodia extending from all points of the surface, short, finger-like, unbranched. Flagellum longer than the body, with a broad base. Nucleus spherical; contractile vesicle single.

Length, 15–25 microns. (Fig. 43, Pl. VII.)

A minute form corresponding to the above description has been observed in pond water from several localities in this state. In some respects the organism conforms to *Mastigamœba simplex* S. K., although the Iowa variety is usually wider posteriorly and the pseudopodia are smooth.

This species, as others of the genus, may be considered as occupying an intermediate position between the *Sarcodina* and *Mastigophora*, possessing as it does some striking characters of the former. There is, however, not such a marked differentiation between the endoplasm and ectoplasm as in *Amœba*, which it resembles, the outer surface also offering greater resistance to the endoplasm than in *Amœba*.

The flagellum shows indications of being an intermediate structure, it apparently being but a prolongation of the anterior extremity of the body with a broad base as if a tapering pseudopodium were long drawn out and endowed with the power of vibration.

No indications of a mouth are present, the food probably being ingested at any point in the surface as in *Amœba*.

Habitat, pond water among diatoms and other unicellular plants. Found in Van Buren, Louisa and Johnson counties.

ACINETACTIS Stokes.

Spheroidal in shape, capable of extending capitate pseudopodia from all points of the periphery. Flagella two in number, approximately equal in length.

ACINETACTIS MIRABILIS Stokes.

Body nearly spherical, with slender capitate pseudopodia extending from all parts of the periphery, these pseudopodia also bear one or more protoplasmic swellings along the course of the

rays; short, lobate pseudopodia also may sometimes be present. Flagella two in number, nearly equal in length, originating from the anterior border some distance apart.

Diameter of the body, 10–15 microns. (Fig. 44, Pl. VII.)

This organism also stands on the border line between the *Sarcodina* and *Mastigophora*, possessing some characters of each, and by way of such forms as this must be traced the ascent from the lowest unspecialized, to the more highly organized protozoan cells.

No oral opening has been observed and no doubt *Acinetactis mirabilis* ingests food as does *Amœba*, the pseudopodia serving similar functions in both animals.

By stimuli of various sorts the organism may be induced to withdraw its pseudopodia entirely and then, in appearance, it resembles a true flagellate.

I have observed reproduction to take place by longitudinal fission, the point of division being between the flagella, an additional flagellum being formed on each portion before complete separation. One or two contractile vesicles are present, also a centrally located spherical nucleus.

Figure 44, Plate VII, illustrates a normal individual. Found but a few times in this state. Habitat, pond water.

Family, HETEROMONADIDÆ.

ANTHOPHYSA Bory d. St. Vincent.

Animals united in compact clusters, often attached to a somewhat rigid, simple or branched stalk. Bodies pear-shaped, each with two flagella of unequal length.

ANTHOPHYSA VEGETANS Müll.

Bodies attached in rosette-like clusters, each zoöid pyriform in shape, obliquely truncate anteriorly, provided with two flagella of unequal length. Clusters often attached to a branched pedicle.

Length of body, 5-10 microns. (Figs. 47-48, Pl. VII.)

Many diverse opinions concerning this species have been held by authorities. Some have regarded it as an aquatic fungus, while others have considered it to be an intermediate organism between the plant and animal series.

Often myriads of detached clusters of the species may be seen rolling through the water in the fashion of *Volvox*. The clusters are composed of zoöids from a few in number to fifty or sixty bound together rosette-like by some substance which disintegrates very quickly under the action of chemicals.

Each zoöid is more or less transparent, has a nucleus, contractile vesicle and two flagella unequal in length and, for a time at least, can lead an independent existence. Large clusters break up into small groups of four or five zoöids and by longitudinal fission of these the normal size of the cluster is again reached.

Sometimes a number of clusters are found attached to the terminations of a branched stalk. This pedicle is a product of excretion and is longitudinally striated. In older stages the stalks are dark brown in color and may be seen in large tangled masses devoid of zoöids. Fig. 47, Pl. VII, represents a detached cluster and Fig. 48, Pl. VII, shows the branched pedicle with clusters of zoöids attached.

Found nearly everywhere in stagnant and fresh water.

Order, CHOANOFLAGELLIDA.
Family, CRASPEDOMONADIDÆ.

CODOSIGA James-Clark.

Animals forming a colony, usually attached by means of a branched, rigid stalk. Bodies oval or spherical with a prominent collar. Flagellum single.

CODOSIGA BOTRYTUS Ehr.

Bodies ovate, zoöids few in number, attached to the extremity of a long, slender, rigid pedicle. Flagellum long. Collar equalling the body in length. Nucleus spherical, centrally located.

Length of body, 10–15 microns. (Fig. 49, Pl. VII.)

In this species the zoöids appear to be attached to the pedicle by means of short secondary branches, but these, according to Kent, are but the extensions of the posterior regions of the zoöids and during longitudinal fission also undergo division.

The same authority reports another interesting phenomenon exhibited by *Codosiga botrytus*, stating that before passing into the encysted state the zoöids become amœboid, pseudopodia-like processes being projected from the body and even from the collar.

The species has been found many times usually attached to aquatic plants. Fig. 49, Pl. VII, illustrates an individual from Johnson county.

Commonly the number of zoöids attached to one pedicle, as observed by the writer, has been from four to eight.

The stalk may reach six or eight times the length of a single zoöid.

MONOSIGA S. K.

Not forming colonies. The body oval or spherical, sometimes changeable in form, sessile or with a short stalk. Collar prominent. Flagellum single.

MONOSIGA STEINII S. K.

Body ovate, wider centrally, tapering toward each extremity, attached in a sessile manner to some support. Collar nearly equalling the body in length.

Length of body, 12–15 microns. (Fig. 45. Pl. VII.)

The minuteness of size renders impossible a very satisfactory study of this organism. It is found usually attached to the pedicle of some species of *Vorticella*.

During the summer of 1905 it was found in abundance attached to the stalk of *Vorticella campanularia* in a running stream near Iowa City. The species has also been observed attached to the pedicle of *Vorticella convallaria*. As many as fifteen or twenty of these minute collared flagellates may be seen adhering to the contractile stalk of a single *Vorticella*. By the use of reagents a centrally located, spherical nucleus may be brought to view.

Order, HETEROMASTIGIDA.
Family, BODONIDÆ.

HETEROMITA Dujardin.

Body usually oval or elongate but changeable in form. Flagella two in number, arising from the anterior or lateral borders of the body, one directed forward vibratile, the other trailing. No distinct mouth.

HETEROMITA sp.

Figure 50, Plate VII, represents a species observed in this state which, without doubt, must be referred to this genus.

The species, as most others of the genus, was exceedingly minute. From near the anterior extremity of the elongate-oval body arose two flagella, the anterior one vibratile, the slightly longer posterior one trailing.

A contractile vesicle was present anterior to the middle of the body. The nucleus could not be detected. Movements oscillatory. Habitat, stagnant water.

Length of body, 15 microns.

Order, POLYMASTIGIDA.
Family, POLYMASTIGIDÆ.

TREPOMONAS Dujardin.

Irregular in form but usually rounded posteriorly, with lateral anterior lobes when seen from a lateral point of view. Flagella two, equal in length, one arising from each lateral border.

TREPOMONAS AGILIS Duj.

Body exceedingly irregular in shape, different appearances being presented from different points of view; when viewed laterally the body is rounded posteriorly, expanding anteriorly into two broad wing-like lateral lobes, which curve backward nearly to the center of the body. Flagella two in number, one arising from the posterior tip of each lateral lobe-like expansion.

Length, 10–20 microns.

This species is one of the smallest of free-swimming Protozoa to be found in this state. Its movements are very rapid and difficulty is often experienced in making a satisfactory study of it in the living condition. The lateral view as described above and illustrated by Fig. 46, Pl. VII, is the one by which the organism is most readily recognized. From other points of view various impressions as to its form are given, and when in rapid motion the body often has the appearance of being spirally twisted.

No oral aperture is visible and probably food may be ingested at any point in the surface.

Found in pond water, widely distributed.

Order, EUGLENIDA.
Family, EUGLENIDÆ.

EUGLENA Ehrenberg.

Body elongate, changeable in form. Endoplasm usually bright

green in color. Flagellum single, inserted in a notch-like excavation on the anterior border. Eye-spot usually present.

EUGLENA VIRIDIS Ehr.

Body usually rounded anteriorly, with a colorless tail-like posterior prolongation, surface smooth. Nucleus central, contractile vesicle and eye-spot in the anterior region.

Length of body, 50-75 microns. (Fig. 51, Pl. VIII.)

This specimen is one of the most common forms of the class to be found in fresh and stagnant waters. That *Euglena viridis* possesses a distinct oral aperture has long been demonstrated and although the organism may depend in part upon the chlorophyl which it usually contains, there is no doubt but that it may at any time ingest organic substances and during periods, when the chlorophyl is lost, may exist entirely upon food obtained in this manner.

There may be periods of more or less duration during which no chlorophyl or pigment spots are present, and at the same time the activity of the organism is not apparently lessened.

That *Euglena viridis* is extremely sensitive to the various forms of stimuli and changing conditions, may be readily observed in the laboratory. The organism is repelled by cold and darkness, attracted by heat and light. A few hours in total darkness has proved sufficient to cause the species to become encysted. Other conditions even in a state of nature frequently cause the chlorophyl to break down into pigments of various colors. Starch-like bodies are often contained within the endoplasm.

Reproduction takes place by longitudinal fission and also by spore formation.

Figure 51, Plate VIII, illustrates a normal individual of the species. Often found on the surface of stagnant water in masses visible to the naked eye. Also found commonly among algæ.

EUGLENA SPIROGYRA Ehr.

Body elongate, cylindrical, posterior extremity terminating in a pointed, tail-like prolongation, endoplasm usually bright green, the periphery covered by oblique rows of minute, bead-like elevations. Nucleus centrally located on either side of which is usually an elongated elliptical starch-like body, contractile vesi-

cle and eye-spot in the anterior region near the base of the flagellum.

Length of body, 100–200 microns. (Fig. 52, Pl. VIII.)

Euglena spirogyra is the largest species of the genus coming under my observation. The body ornamented in a spiral fashion is frequently found in a twisted and contorted condition and the bead-like elevations may be partially or entirely wanting. It is a much more sluggish organism than *Euglena viridis*, the flagellum being comparatively short. Usually found in fresh water among algæ, mostly solitary.

EUGLENA ACUS Ehr.

Body exceedingly elongate, anterior end truncate, posterior end sharply pointed. Flagellum short. Nucleus central, contractile vesicle anterior, pigment spot and amylaceous bodies conspicuous.

Length of body, 75–150 microns. (Fig. 54, Pl. VIII.)

The great length compared with the width and the apparent rigidness of the body may readily distinguish this species from other members of the genus. The organism may exceed in length twelve times its greatest breadth and the body is seldom or never flexed.

Usually the starch-like bodies appear as elongate rectangular structures, one anterior and the other posterior to the nucleus. The flagellum is very short and movement of the animal, when it takes place, is very slow.

Found nearly everywhere in pond water, often abundantly among algæ, etc.

EUGLENA DESES Ehr.

Body elongate, worm-like, capable of amœboid movements. Flagellum short. Nucleus, contractile vesicle and pigment spot present. Amylaceous bodies usually scattered throughout the endoplasm. Color green.

Length of extended body, 50-100 microns. (Fig. 53, Pl. VIII.)

As an organ of locomotion, the flagellum of *Euglena deses* is of little value, movements usually being confined to exceedingly slow amœboid contortions of the body. In young individuals the flagellum may be wanting. The species is usually solitary in its habits, being found not infrequently in fresh water among algæ.

PHACUS Dujardin.

Body flattened, leaf-like, with a tail-like posterior prolongation. Oral opening distinct. Flagellum single, eye-spot present. Color usually green.

PHACUS PLEURONECTES Müll.

Body flattened, oval in outline with a short posterior tail-like projection, usually curved. Surface longitudinally striated. Endoplasm bright green enclosing one or more large circular amylaceous bodies. Nucleus often concealed, contractile vesicle and pigment spot near the base of the flagellum, which arises from the cleft-like oral aperture on the anterior border.

Length, 25–75 microns. (Fig. 55, Pl. VIII.)

This species is widely distributed, being found in great abundance in fresh water among aquatic plants, also often developed in infusions of pond water.

There are apparently several varieties of the species found in this state. Fig. 55, Pl. VIII, illustrates a large variety of this species. Associated with this variety is sometimes found a smaller form possessing two lateral amylaceous bodies, with a deep depression extending from the oral aperture in a median line nearly to the posterior border. This may represent an immature phase of *Phacus pleuronectes*. A yet smaller form has been observed, the endoplasm of which has a decidedly bluish appearance. It is not improbable that this form also is a phase of *Phacus pleuronectes*.

PHACUS LONGICAUDUS Ehr.

Body rounded, flattened, produced posteriorly into a long tapering, tail-like prolongation, usually straight. Endoplasm green, enclosing amylaceous bodies. Surface longitudinally striated.

Length, including tail, 100 microns. (Fig. 56, Pl. VIII.)

Phacus longicaudus is recognized by its large size and long caudal projection which may exceed in length half the diameter of the body. Often the posterior half of the organism is twisted on its longitudinal axis giving the striations of the surface an oblique appearance.

The body may become elongated to nearly twice its usual length although, due to the hardness and consistency of the cuticle, the

process requires a long time. The nucleus, centrally located, is usually concealed. A brilliant red pigment spot is placed near the contractile vesicle.

Figure 56, Plate VIII, illustrates a normal individual of this species. Usually solitary in habits, found widely distributed in fresh water.

PHACUS PYRUM Ehr.

Body pyriform, produced posteriorly into a straight, tail-like prolongation. Surface obliquely grooved. Color green.

Length, 38 microns. (Fig. 57, Pl. VIII.)

This species is often found in great numbers in fresh water associated with *Euglena viridis* and aquatic plants of low rank.

The nucleus is usually concealed. A contractile vesicle and pigment spot are anteriorly located near the base of the flagellum. In motion the body follows a meandering course, rolling on its longitudinal axis.

CHLOROPELTIS Stein.

Oval, sometimes flattened, posterior extremity tail-like, anterior border with a small conical projection. Flagellum single. Endoplasm green. Surface with or without striations.

CHLOROPELTIS OVUM Ehr.

Body oval, cylindrical, with an anterior conical projection from which arises a long flagellum, posterior extremity prolonged into a straight, tail-like process. Endoplasm green, usually enclosing four amylaceous bodies laterally placed. Surface of the body often striated.

Length, 42 microns. (Fig. 58, Pl. VIII.)

Found in fresh water with *Euglena viridis*. Not an abundant form in this state.

CHLOROPELTIS HISPIDULA Eichwald.

Body oval, flattened, with a tail-like projection. Surface of the body ornamented with minute spines arranged in longitudinal rows. Endoplasm green, with eye-spot.

Length, 55 microns. (Fig. 59, Pl. VIII.)

This species is exceedingly rare in the waters of this state, as it has been observed but once and that was in Johnson county. In

this individual the caudal appendage was straight; seven longitudinal ribs were present on either of the flattened surfaces, each rib being thickly set with minute spines which pointed posteriorly. Habitat, fresh water among diatoms.

Besides the two species of *Chloropeltis* already referred to there appears in this state another form which, in my opinion, should be referred to this genus.

The oval body, broadly rounded at each extremity, possesses the characteristic elevation on the anterior border from which arises a long flagellum. A small, conical projection arises from the posterior border. The surface is grooved in an oblique direction. Usually the endoplasm is colored bright green although colorless individuals are not infrequently seen. In these latter the oblique markings are evident. This form is more abundant than *Chloropeltis hispidula* in this state but usually solitary in habits. Habitat, fresh water.

Length, 50–60 microns. (Fig. 60, Pl. VIII.)

TRACHELOMONAS Ehrenberg.

Body inhabiting a hard, brittle lorica usually brownish in color. Flagellum single, protruding through the single aperture. Endoplasm usually green, with nucleus, contractile vesicle and eyespot present.

TRACHELOMONAS PISCATORIS Stokes.

Lorica flask-shaped, cylindrical, less than twice as long as broad, surface clothed by numerous short, conical spines. Both extremities equally rounded, the anterior produced into a smooth, cylindrical, neck-like prolongation, the border of which is deeply toothed.

Length, 36 microns. (Fig. 64, Pl. IX.)

The above description as given by Dr. Stokes well characterizes a form frequently observed in the waters of this state.

Thirty-six microns has been observed by the writer to be the approximate length of the lorica of the mature organism. Its distribution over the state is general. Habitat, fresh water, among aquatic plants.

TRACHELOMONAS CYLINDRICA (?) Ehr.

Lorica very elongate, cylindrical, surface smooth, anterior extremity produced into a short, tubular neck. Color usually brown.

Figure 65, Plate IX, illustrates a form which was observed in the vicinity of Iowa City during the autumn of 1903.

In many respects it differs from the description of *Trachelomonas cylindrica*, as found in Kent's "Manual of The Infusoria." The lorica did not present the flattened appearance of the posterior border and the distal margin of the tubular neck was conspicuously everted.

The lorica was transparent, rendering visible the bright green endoplasm and red pigment spot. Flagellum long. Length of lorica, approximately, 20 microns. Habitat, fresh water.

I refer the form to this species with much doubt as to its true identity. It possibly may have been an undeveloped phase of some other species of the genus.

TRACHELOMONAS ARMATA Stein.

Lorica nearly as broad as long, the surface finely punctate. A series of short, sharp spines arranged in irregular rows about the aperture, and frequently a number of long slender spines, curved when mature, arranged around the posterior extremity. Aperture usually in a shallow depression. Color brown.

Length, 40 microns.

This is the largest species of the genus observed in the state. It has most frequently been found devoid of posterior spines, this condition being, perhaps, a mark of immaturity. The posterior spines when present have, in many forms examined, been long and curved as represented by Fig. 66, Pl. IX. Other individuals observed possessed long, slender, but straight spines. Probably full development had not been reached by these specimens when examined, as Dr. T. C. Palmer reports that the curved spines are late additions in the development of the organism. Usually fourteen or more short, conical spines are arranged about the aperture in two or three irregular rows. These are produced before the posterior spines make their appearance.

The species is widely distributed over the state, having been found in many sections. It is, however, not an abundant species.

Habitat, fresh water with algæ and diatoms.

TRACHELOMONAS HORRIDA Palmer.

"Lorica ovoid, brown, the general surface tuberculate, beset with long, nearly straight, prismatic, abruptly pointed spines,

longer on the ends than on the sides. Aperture plane, or produced into a short trumpet-shaped tube with wavy limb. Monad green, pigment-spot obvious. Flagellum long."

Length of Iowa forms, 35–40 microns. (Fig. 69, Pl. X.)

Dr. T. C. Palmer, of Pennsylvania, whom I have quoted, discovered and described this species. A mature specimen may readily be distinguished from other members of the genus.

It is an extremely rare form in this state, having so far been found but a few times. Dr. Palmer kindly identified specimens collected by the writer during the summer of 1905.

Habitat—Found in Iowa among diatoms and other aquatic plants.

TRACHELOMONAS VOLVOCINA Ehr.

Lorica nearly spherical, usually brown in color, surface nearly smooth, commonly without a neck.

Diameter of lorica of large specimen, 30 microns. (Figs. 67-68, Pl. IX.)

Trachelomonas volvocina is the most common species to be observed in this state. The size and the shape of the lorica varies greatly, the spheroidal variety is, however, more numerous. Sometimes loricæ, evidently of this species, may be found having short cylindrical necks and in some the tube-like neck may extend inward toward the protoplasm of the body. Fig. 68, Pl. IX, represents a common form, probably of this species. Flagellum long.

Habitat, fresh water among diatoms, algæ and other aquatic plants.

TRACHELOMONAS HISPIDA Stein.

Lorica usually elongate-oval with ends broadly rounded. Surface covered with minute, sharp pointed spines. Aperture on a level with the anterior border or truncating a short, tube-like neck. Color, some shade of brown.

This form is widely distributed over the state, being commonly found associated with *Trachelomonas volvocina*. The species may present a variety of shapes; those most frequently observed in this state, however, are as represented by Fig. 70, Pl. X.

Large specimens from the locality of Iowa City have reached a length of from 30–36 microns.

TRACHELOMONAS sp.

Probably a new species.

Lorica ovate, widest and broadly rounded anteriorly, narrow and acutely rounded posteriorly. Surface punctate in a regular manner, the punctæ being arranged in oblique rows in two directions. Aperture plane, a neck never being produced. Flagellum long. Endoplasm usually green. Color of lorica some shade of brown.

Length, 27 microns. (Fig. 71, Pl. X.)

A species, the chief characters of which are given above, has been found in Johnson county, Iowa.

Dr. T. C. Palmer of Media, Pa., whose work upon this particular genus is deserving of no little merit, after examining specimens sent him for identification, considered that the Iowa form was probably a new species. It apparently resembles, in outline, *Trachelomonas reticulata* Klebs, but the recticulate surface has not been made out in the species in this state; on the other hand, the punctæ which cover the surface are arranged with the regularity described above.

Habitat, infusions of pond water among decaying vegetation, being developed in great numbers on the occasions observed.

Distribution has not thus far been found to be general. It is hoped that further observation may reveal a more complete knowledge of the organism.

CRYPTOGLENA Ehr.

Body flattened, persistent in shape. Two lateral, brightly colored pigment bands. Flagellum single. Mouth, eye-spot, nucleus and contractile vesicle usually visible.

CRYPTOGLENA PIGRA Ehrenberg.

Body oval, somewhat flattened, pointed posteriorly. Flagellum single, short. Two bright green pigment bands one on either side following the contour of the body. A scarlet pigment spot near the anterior extremity, nucleus posterior to the center of the body.

Length, 12 microns. (Fig. 83, Pl. XI.)

Cryptoglena pigra is not abundant in this state but may be found associated with *Euglena viridis* in fresh water.

Family, ASTASIIDÆ.

ASTASIA Ehrenberg.

Body elongate, plastic, changeable in form; flagellum single, arising from the anterior extremity; endoplasm transparent.

ASTASIA TRICHOPHORA Ehr.

Body elongate, wider posteriorly, tapering toward the narrow anterior extremity. Flagellum long and thick. Nucleus centrally located; contractile vesicle in the anterior region.

Length of the extended body, 30–60 microns. (Figs. 72-73, Pl. X.)

Astasia trichophora is interesting because it bears evident marks of ancestral characters. The body of the organism is exceedingly plastic, yet progress in development has gone so far as to render the periphery a sufficient resistant to the endoplasm that no pseudopodia are produced. The amœboid changes of form are due to contraction of the peripheral protoplasm, usually in a longitudinal direction.

When freely moving *Astasia* is usually elongate with the narrow extremity in advance, then suddenly it doubles on itself or contracts into an irregular mass, resuming the elongate form again as it continues its course.

At times the posterior border may be prolonged into a short tail-like extension. At the base of the long, thick flagellum is a more or less distinct oral opening which leads into a pharyngeal tube which is highly extensile. No eye-spot or coloring matter is developed, the endoplasm being transparent.

Figure 72, Plate X, represents an elongate form. Fig. 73, Pl. X, a partially contracted individual. *Astasia trichophora* is found almost everywhere in fresh water, commonly occurring among diatoms, algæ, etc.

DISTIGMA Ehrenberg.

Body changeable in form, more or less elongate when extended. Flagella two in number, unequal in length, both directed forward. Oral opening at the base of the flagella leading into a long pharynx. Endoplasm transparent.

DISTIGMA PROTEUS Ehr.

Body exceedingly plastic, when contracted greatly distended

in one or more regions; both flagella vibratile, one equalling the body in length, the other about one-half that length. Endoplasm transparent with dark colored corpuscles, which are shifted about by the movements of the body. Nucleus central, contractile vesicle in the anterior region.

Length of the extended body, 95 microns.

Figure 74, Plate X, illustrates the species as it commonly appears in a mature condition and extended. Fig. 75 represents the partially contracted state.

The species is not uncommon in pond water.

Family, PERANEMIDÆ.

HETERONEMA Dujardin.

Body oval or elongated, changeable in shape. Flagella two in number, one directed forward, one trailing, both arising from the anterior extremity. Oral aperture near the base of the flagella.

HETERONEMA ACUS Ehr.

Body greatly elongated when extended, wider centrally, tapering toward each extremity. Anterior flagellum about as long as the body and twice as long as the trailing one. Contractile vesicle in the anterior extremity, nucleus centrally located.

Length, when extended, 50 microns. (Fig. 76, Pl. X.)

Heteronema acus is exceedingly plastic and changeable in form, becoming shortened and greatly distended on contraction. The long anterior flagellum is not highly vibratile. Found in fresh water in Johnson and Keokuk counties.

PETALOMONAS Stein.

Somewhat oval; flattened, and of hardened consistence. Flagellum single. Oral aperture distinct.

PETALOMONAS MEDIOCANELLATA Stein.

Body ovate, flattened, persistent in shape, broadly rounded posteriorly, tapering to an acutely pointed anterior extremity. Flagellum single, arising from the anterior extremity and directed in advance of the body, a distinct groove leading from the base of the flagellum posteriorly.

Length of the body, 30-40 microns. (Fig. 77, Pl. XI.)

Petalomonas mediocanellata is to be found frequently in fresh water among aquatic plants. Its movement is smooth and gliding, the tip of the long flagellum being vibratile. Due to the groove in the median line of the body food particles are conducted to the posterior region where digestion takes place. It is in this region that the spherical nucleus is to be found. The contractile vesicle is lateral to the oral groove in the anterior region, which is comparatively free from granular particles.

ANISONEMA Dujardin.

Body ovate, flattened, persistent in form. Oral aperture leading into a long pharynx. Flagella two in number, the vibratile one arising from the ventral border, and directed forward, the posterior one long, arising posterior to the vibratile one and curving backward in a trailing manner. Contractile vesicle or vesicles anterior, nucleus posterior.

ANISONEMA ACINUS Duj.

Body with ventral surface flattened, wider posteriorly, the anterior flagellum short, vibratile, the posterior one with a thickened base, long, trailing. Oral opening near the base of the anterior flagellum. Endoplasm transparent, contractile vesicle and nucleus conspicuous.

Length, 25 microns. (Fig. 78, Pl. XI.)

This species of the genus is widely distributed, being found nearly everywhere in pond water, among diatoms and other aquatic plants. Its movement is usually forward in a straight line, the trailing flagellum serving as a rudder directing the course. Reproduction takes place by longitudinal division.

ANISONEMA LUDIBUNDUM S. K.

Body nearly oval, narrower at the anterior extremity. Flagella two in number, about twice the length of the body, inserted at some distance from the anterior end. Contractile vesicles often more than one.

Length, 10 microns. (Fig. 79, Pl. XI.)

This smallest species of the genus has come under my observation but a few times. By means of the posterior flagellum the organism may temporarily attach itself. Progress is made by short oscillating movements.

The point of insertion of the flagella will aid in the recognition of this minute form. Habitat, fresh water.

ANISONEMA TRUNCATUM Stein.

Body elongate-ovate, posterior extremity narrowest, anterior border with a shallow concavity at the bottom of which is the oral aperture. Flagella two, the anterior vibratile one about one-half as long as the posterior trailing one. Contractile vesicle anterior.

Length, 30 microns. (Fig. 80, Pl. XI.)

A rare form in this state. Observed only in Johnson county. Habitat, pond water.

ENTOSIPHON, Stein.

Oval, somewhat flattened, and of a hardened consistence. Oral aperture in the anterior border, followed by an elongated tube-like pharynx. Flagella two in number, arising on the anterior border.

ENTOSIPHON SULCATUS Duj.

Body oval, flattened, the anterior border oblique with a deep concavity, at the bottom of which is the oral opening leading into a long tubular pharynx which reaches into the posterior region of the body. Surface of the body grooved longitudinally. Flagella two in number, arising from the anterior border near the oral opening, one long, tralling, the other shorter, directed in advance, vibratile. Nucleus spherical, in the posterior region, contractile vesicle anterior. Endoplasm transparent.

Length of body, 22 microns. (Fig. 81, Pl. XI.)

The long cone-shaped pharynx of this species is very conspicuous. At times it may be partially exserted and owing to its indurated character persists for a long time after the death and decomposition of the organism.

Frequently found in pond water among aquatic plants. Movements oscillating.

Family, NOTOSOLENIDÆ.

NOTOSOLENUS Stokes.

Somewhat oval and flattened, ventral surface convex, dorsal surface concave. Flagella two, the anterior, long one held obliquely, the posterior trailing one very short.

NOTOSOLENUS OPOCAMPTUS Stokes.

Body ovate, the anterior border acutely rounded, the posterior truncate. Flagella two in number, unequal in size and length, the longer projecting obliquely in advance, the shorter trailing.

Length of body, 12 microns. (Fig. 82, Pl. XI.)

Members of this genus may be recognized at once by the oblique manner in which the anterior flagellum is held as the animal moves in a direct course. In *Notosolenus opocamptus* the shorter and smaller flagellum has its origin on the ventral surface near the base of the anterior one and is directed backward hardly one-half the length of the body. It appears as a minute white line on the background of the body. Frequently found in fresh water among aquatic plants. Its distribution over the state is general.

Order, PHYTOFLAGELLIDA.
Family, CHRYSOMONADIDÆ.

NEPHROSELMIS Stein.

Somewhat oval, ventral border concave. Bright colored pigment bands near the periphery. Flagella two in number, of unequal length.

NEPHROSELMIS OLIVACEA Stein.

Body rounded dorsally, slightly concave ventrally, pigment bands following the dorsal and lateral contours of the body. Flagella two, unequal in length, arising from the ventral concave surface. Nucleus in posterior region.

Length, 10 microns. (Fig. 84, Pl. XI.)

This species is a very rare form, having been found in this state but a few times. Its habitat is pond water among aquatic plants.

MALLOMONAS Perty.

Body oval, persistent in shape, surface covered with long, rigid setæ. Flagellum single, inserted at the anterior extremity. Endoplasm often colored.

MALLOMONAS sp.

Figure 85, Plate XI, illustrates a species which rarely may be found in this state. There is no question but that it must be

referred to this genus, but the specific identification is uncertain, largely due to an incomplete study of the organism.

The oval body, narrower at the anterior extremity, was thickly clothed with long, apparently rigid, hair-like setæ. In general appearances the form resembled *Mallomonas Plosslii* Perty. A magnification of five hundred diameters, however, did not reveal the crenulation of the surface which is a character of the last named species. Whether the long flagellum, directed in advance, possessed the retractile power or not I cannot state. One or more contractile vesicles were evident but the nucleus could not be distinguished.

Movement, rapid in a direct course. Color, yellowish brown. Habitat, pond water.

According to Kent the rigid hair-like structures which cover the surface are attached to the hardened cuticle and have no direct connection with the inner endoplasm.

Length of the body as observed, 15-30 microns.

Family, CRYPTOMONADIDÆ.

CHILOMONAS Stein.

Elongate-oval, anterior border with a projecting upper-lip. Flagella two in number, nearly equal, both directed in advance. Oral aperture on the anterior border near the base of the flagella.

CHILOMONAS PARAMÆCIUM Ehr.

Body elongate-oval in shape, usually rounded posteriorly, anterior margin with a prominent lip-like projection. Flagella two in number, sub-equal in length, arising from the lip-like extension, both directed forward, oral opening near the base of the flagella. Nucleus central, contractile vesicle anterior. Endoplasm usually enclosing dark-colored corpuscles.

Length of body, 25-40 microns. (Fig. 86, Pl. XI.)

Chilomonas paramæcium is one of the most common flagellates of stagnant infusions. The flagella are delicate and difficult to see during the activity of the organism. The lower one being slightly shorter is often thrown into a coil and serves as an anchor to temporarily attach the organism to some support. In progression the animal takes a zigzag, roving course, rolling on its longitudinal axis.

Reproduction takes place by longitudinal division with great rapidity. Two other flagella are first developed from the anterior border, then a longitudinal constriction is seen to take place and the two portions of the organism seem to be rapidly drawn apart.

Widely distributed, everywhere in stagnant water.

CRYPTOMONAS Ehrenberg.

Body ovate, with a prominent anterior lip-like process. Flagella two in number, nearly equal in length, directed forward, oral aperture at the base of the flagella. Endoplasm containing color bands disposed in a longitudinal manner. Contractile vesicle anterior, nucleus near the middle of the body.

CRYPTOMONAS OVATA Ehr.

In size and appearance, except for the coloring matter, *Cryptomonas ovata* resembles *Chilomonas paramæcium*. The lip-like process is very prominent, beneath which is a spacious buccal cavity leading posteriorly into the endoplasm, the oral aperture at times being widely distended. The species as found in this state invariably possesses two broad, lateral, chlorophyl bands extending from the posterior to the anterior extremity, one on either side of the body. Its common habitat is fresh water with other chlorophyl-bearing flagellates. Widely distributed.

Length of body, 50 microns. (Fig. 87, Pl. XI.)

Family, CHLAMYDOMONADIDÆ.

CHLAMYDOMONAS Ehrenberg.

Enclosed within a membranous, transparent sheath. Body oval or spherical. Flagella two in number. Endoplasm green with an eye-spot, nucleus, contractile vesicles, chromataphores and starch-like bodies.

CHLAMYDOMONAS sp. (?).

Lorica transparent, somewhat truncate anteriorly, narrower and rounded posteriorly. Body green, filling little more than half the lorica; flagella two in number, of equal length. A pigment-spot usually present.

Length of lorica, 12 microns. (Fig. 61, Pl. IX.)

This species is not an abundant form in this state. It has frequently been found in pond water in Johnson county, but apparently is not of wide distribution.

CHLAMYDOMONAS sp.

Lorica transparent, elongate-oval, rounded anteriorly, often acutely pointed posteriorly. Body usually green, almost completely filling the lorica. Flagella two in number, of equal length. A contractile vesicle and pigment spot near the base of the flagella, nucleus central.

Length of lorica, 15-20 microns. (Figs. 62-63, Pl. IX.)

This species which I have referred to the genus *Chlamydomonas* differs materially from the one previously described both in the shape of the lorica and the comparative size of the body. In some respects it resembles *Chlamydomonas ovata* Dangeard, and may be identical with that species. It was first observed in an infusion of moss in the locality of Iowa City, during May, 1905. At that time the classification was puzzling, possessing as it did the generic characters of *Chlamydomonas*, but during the two or three weeks it was under my observation, no chlorophyl was present; the organism was transparent, slightly granular.

It was my good fortune, however, to find the same species during the month of July, 1905, in pond water in Appanoose county. The organisms from this locality left no question as to the genus to which they belonged and convinced me that the forms earlier found were in a saprophytic stage. In the same infusion appeared individuals bright green in color with brilliant eye-spots, also perfectly transparent forms with no eye-spots, while others represented intermediate phases between these two extremes. The transition from the saprophytic to the chlorophyl-bearing stage was readily observed. In the immature individuals the lorica is not easily distinguished from the body, which is usually in close contact with its transparent, investing membrane. In mature specimens, however, the lorica extends beyond the posterior region of the body, either with a rounded border or drawn out into an acute point. The lateral and anterior borders of the body may often be drawn away from the lorica, leaving it visible as a delicate line.

Reproduction usually takes place by means of segmentation of

the entire body, the organism dividing into four, then into eight small zoöids, which break through the lorica and begin an independent existence. As a result of the rapid reproduction myriads of individuals may be developed in a short time. One or two small contractile vesicles may be observed near the base of the long flagella, also a brilliant red eye-spot. A centrally located nucleus is rendered visible by reagents.

On one occasion longitudinal division was observed to take place. The species has been found in this state only in the two localities named above. Habitat, pond water among decaying vegetation, or damp moss from the base of trees.

TABLE OF CLASSIFICATION.

Class, INFUSORIA.

Protozoa with cilia during embryonic and adult life or embryonic only.

Sub-class, CILIATA.

With cilia during entire existence.

Sub-class, SUCTORIA.

With cilia during embryonic life only, with suctorial or piercing tentacles during adult life.

ORDERS OF CILIATA.

HOLOTRICHA.

Cilia usually covering the entire body, sometimes slightly longer about the oral aperture. Trichocysts often present.

HETEROTRICHA.

Body entirely ciliate, cilia of the oral region longer than those of the general surface and often fused together.

HYPOTRICHA.

Usually flattened with cilia confined to the ventral surface.

PERITRICHA.

Cilia reduced to one or two wreaths or circles.

NOTE.—In some classifications Suctoria is considered as an order, here, however, being used as a sub-class, no order names are given.

Families and Genera of Holotricha.

Enchelinidæ.

Mouth terminal or sub-terminal. Food ingested by swallowing.

Coleps Ehr.
Holophrya C. & L.
Urotricha C. & L.
Enchelyodon C. & L.
Prorodon Ehr.
Trachelophyllum C. & L.
Didinium Stein.
Mesodinium Stein.
Lacrymaria Ehr.

Trachelinidæ.

Body usually bilateral with dorsal surface convex. Mouth terminal or sub-terminal. A neck-like region often present.

Loxophyllum Duj.
Amphileptus Stein.
Dileptus Duj.
Lionotus Wrzes.
Loxodes Ehr.
Trachelius Ehr.

Chlamydodontidæ.

Oval or kidney-shaped. Pharynx distinct, often provided with rods.

Nassula Ehr.
Chilodon Ehr.
Ægyria C. & L.
**Opisthodon* Stein.

Oval, convex dorsally, flattened ventrally. Mouth in posterior half of body. Pharynx with rods.

Chiliferidæ

Mouth anterior or central, usually with an undulating membrane. Pharynx short or absent.

Trichoda Müll.
Leucophrys Ehr.
Glaucoma Ehr.

Frontonia Ehr.
Ophryoglena Ehr.
Loxocephalus Eberh.
Uronema Duj.
Colpidium Stein.
Colpoda Müll.
**Dallasia* Stokes.

Elongated, rounded anteriorly, tail-like posteriorly. Mouth near the anterior end with membranes similar to *Glaucoma*.

UROCENTRIDÆ.

Mouth ventral. Cilia in two broad bands encircling the body.
Urocentrum Nitzsch.

MICROTHORACIDÆ.

Cilia scattered, mouth in the posterior region.
Microthorax Eng.
Cinetochilum Perty.

PARAMÆCIIDÆ.

Mouth lateral, preceded by an oblique oral groove.
Paramæcium Müll.

PLEURONEMIDÆ.

Mouth at the posterior end of a ventral furrow or peristome. Peristome with undulating membrane or membranes.
Lembadion Perty.
Cyclidium Ehr.
Ctedoctema Stokes.
**Pleuronema* Duj.
Slightly larger than *Cyclidium*. No posterior setæ.

CYRTOLOPHOSIIDÆ.

Body at times enclosed within a soft mucilaginous envelope secreted by itself. Mouth at the end of a short furrow. A tuft of cilia at the anterior extremity.
Cyrtolophosis Stokes.

FAMILIES AND GENERA OF HETEROTRICHA.

PLAGIOTOMIDÆ.

Mouth near or posterior to the middle of the body, preceded by a narrow peristomal furrow.

Blepharisma Perty.
Metopus C. & L.
Metopides Quenn.
Spirostomum Ehr.

BURSARIDÆ.

Peristome a broad, triangular depression, sometimes with a conspicuous undulating membrane.

Condylostoma Duj.
**Bursaria* Müll.

Body short, sac-like, obliquely truncate in front, flattened ventrally, convex dorsally. Peristome funnel-shaped, reaching to the middle of the body.

STENTORIDÆ.

Peristome occupying the front border. Mouth in the margin of the peristome, with strong adoral cilia spirally disposed. Body entirely ciliate.

Stentor Oken.

GYROCORIDÆ.

Oval or pear-shaped, with one or two spiral wreaths of strong cilia. A style-like posterior process often present.

Gyrocoris Stein.

HALTERIIDÆ.

Body with an anterior ring of cilia. Sometimes a posterior circle is also present or an equatorial wreath of springing hairs.

Halteria Duj.
**Strombidium* C. & L.

Similar to *Halteria* but without springing hairs. Oral cilia very strong.

FAMILIES AND GENERA OF HYPOTRICHA.

OXYTRICHIDÆ.

Cilia of the ventral surface usually fused into styles or setæ arranged in series, as frontal, ventral, anal, caudal, and marginal. One or more of these series may be wanting.

Urostyla Ehr.

Stichotricha Perty.
Uroleptus Ehr.
Pleurotricha Stein.
Gastrostyla Eng.
Oxytricha Ehr.
Histrio Sterki.
Stylonychia Ehr.
**Holosticha* Wrzes.

Differing from *Oxytricha* in possessing two uninterrupted rows of ventral setæ.

**Urosoma* Kowal.

Resembling *Oxytricha*, but with eight ventral setæ and with a tail-like projection.

EUPLOTIDÆ.

Oval, dorsal surface convex. Anal styles usually well developed but those of other series often reduced in number. Marginal series seldom present.

Euplotes Ehr.
Aspidisca Ehr.

FAMILIES AND GENERA OF PERITRICHA.

NOTE.—Practically all fresh water forms of this order may be included within one family.

VORTICELLIDÆ.

Bodies frequently bell-shaped. Front border bearing a spirally wound wreath of strong cilia; a posterior circle of cilia sometimes developed; otherwise the body is free from cilia. Animals attached or free-swimming, often forming colonies and inhabiting loricæ.

Gerda C. & L.
Scyphidia Duj.
Vorticella Linn.
Carchesium Ehr.
Epistylis Ehr.
Vaginicola Lamarck.
Cothurnia Ehr.
**Zoothamnium* Ehr.

Similar to *Carchesium* but with continuous muscle fibre. The entire colony is highly contractile.

**Rhabdostyla* S. K.

Similar to *Vorticella* but attached by a short rigid stalk. Never forming colonies.

**Pyxidium* S. K.

Animals similar to *Opercularia* but solitary on short rigid stalks.

**Opercularia* Stein.

Forming colonies with a branched but rigid stalk. Animals elongate-oval. Ciliary disc attached by one side and opening and closing like a lid. A delicate collar-like membrane also protruded when the disc is elevated.

Families and Genera of Suctoria.

Podophryidæ.

Spherical or elongate, with or without a stalk. Tentacles scattered or in groups, capitate and suctorial or prehensile.

Sphærophrya C. & L.

Podophrya Ehr.

Acinetidæ.

With or without a lorica, stalked or unstalked. Tentacles usually capitate and in groups or scattered.

Acineta Ehr.

Hallezia Sand.

**Solenophrya* C. & L.

Body oval, enclosed by a lorica and attached in a sessile manner. Tentacles capitate, in groups.

Dendrosomidæ.

Without a stalk or lorica. Tentacles capitate, in groups.

Trichophrya C. & L.

**Dendrosoma* Ehr.

Animals united, forming a branched colony with a common base. Tentacles suctorial, capitate.

NOTE.—In the above table of classification only families, representatives of which have been observed in this state, are included. Species of genera marked with the asterisk (*) have not, so far, been observed in the state.

Class, INFUSORIA.
Sub-class, CILIATA.
Order, HOLOTRICHA.
Family, ENCHELINIDÆ.

COLEPS Ehrenberg.

Ovate, persistent in shape. Surface usually deeply furrowed longitudinally and transversely, the furrows bearing cilia. Oral aperture terminal, surrounded by cilia larger than those of the general surface. Posterior border often bearing spines.

COLEPS HIRTUS Ehr.

Body barrel-shaped, elongate, cylindrical. Mouth terminal, bordered by tooth-like processes. Posterior border rounded, with three spines. General surface furrowed at right angles giving the appearance of small rectangular, raised areas which are indurated.

Nucleus large, spherical, in the central or posterior region. Contractile vesicle posterior.

Length, 60 microns. (Fig. 88, Pl. XII.)

Coleps hirtus is a very common species in pond water and old infusions. The organism usually appears late in the infusion, after most of the other forms have disappeared, being a scavenger feeding upon decaying matter. Should another infusorian, as *Paramœcium*, die, a group of these organisms gather about the dead protoplasm, devouring it rapidly and greedily. The mouth is capable of wide extension during feeding and the body may become nearly spherical, due to ingested material.

Reproduction takes place by transverse fission, an interesting feature presenting itself in this connection. The constriction of the body commences with the middle transverse furrow, the opposite extremities of the dividing cell retaining the reticulate appearance, but the newly developed central area bears no furrows. Even after complete separation one-half of each new individual, bearing the reticular area, is sharply contrasted with the smooth unfurrowed region. After a period of more or less duration the smooth half begins to take on the furrowed appearance and finally reaches the same proportions as the opposite portion.

HOLOPHRYA Ehrenberg.

Ovate or elongate, changeable in form. Oral opening in anterior border, terminal. Cilia of entire body of uniform size.

HOLOPHRYA KESSLERII Meresch.

Body elongate, cylindrical, posterior border rounded, anterior border truncate. Surface furrowed longitudinally. Nucleus elongate, band-like, centrally located. Contractile vesicle posterior.

Length when extended, 125 microns. (Fig. 89, Pl. XII.)

A rare form in this state. It has been found in fresh water in Johnson county among algæ. Solitary in its habits. Movement rapid, by turning on its longitudinal axis. On contraction the longitudinal striations do not become oblique as in case of *Holophrya tarda*, a closely allied form.

UROTRICHA C. & L.

Oval or elliptical. Cilia not moving in unison. Oral aperture at the anterior extremity, terminal. A long seta used as a springing hair, developed from the posterior extremity. Contractile vesicle and nucleus usually conspicuous.

UROTRICHA PLATYSTOMA Stokes.

Body ovate, a little longer than broad, equally rounded at both extremities. Cilia covering the entire body, vibrating independently. Surface covered with minute, round, bead-like elevations arranged in longitudidal series. Mouth capable of very wide expansion. Springing hair shorter than the body, pointing obliquely, with the distal end curved.

Length of body, 40 microns. (Fig. 90, Pl. XII.)

Urotricha platystoma reproduces by transverse division. Movement is by rotation on its longitudinal axis, frequently darting to one side by means of the posterior springing hair, not unlike *Halteria*.

The form has often been found in fresh water in this state.

UROTRICHA sp.

Body ovate, wider anteriorly, more acutely rounded posteriorly. Surface smooth. Movement of cilia very irregular and independent. Oral aperture apical, terminal, provided with two lip-like extensions of unequal length. Springing hair short, less than

half the length of the body, straight. Nucleus central. Contractile vesicle posterior.

Length of body, 35 microns. (Fig. 91, Pl. XII.)

This species of *Urotricha* has been found in Johnson county, associated with *Cyclidium glaucoma*.

It differs from *Urotricha lagenula* Ehr. (not observed in this state) in the inflation of the anterior region and the short length of the springing hair. The oral opening has two protruding lip-like processes and is capable of very wide expansion during the process of ingestion of food. Its breadth when expanded may almost equal the greatest width of the body. When closed the lip-like protrusions meet, one, however, being decidedly shorter than the other. The organism has the habit of a scavenger, dead protoplasm serving as its chief food.

A central spherical nucleus may be observed by the aid of reagents and a single contractile vesicle is present in the posterior region.

In its movement the species usually rotates on its longitudinal axis, the springing action not being so noticeable as in *Urotricha platystoma*,

Reproduction takes place by transverse fission.

ENCHELYODON C. & L.

Body ovate, rounded posteriorly, narrower anteriorly but not produced into a neck-like extension. Oral aperture terminal, followed by a pharynx which is striated in a longitudinal direction.

ENCHELYODON FARCTUS C. & L.

Body oval, narrower anteriorly and often slightly curved. Pharynx conspicuous and can be traced for some distance within the endoplasm. Nucleus band-like, long and curved. Contractile vesicle posterior. Endoplasm transparent.

Length, 220 microns. (Fig. 92, Pl. XII.)

Enchelyodon farctus has been found abundantly in Johnson county in infusions of pond water.

Reproduction is by transverse fission.

PRORODON Ehrenberg.

Usually oval, sometimes slightly flattened, evenly rounded at both extremities. Mouth terminal or sub-terminal; pharynx

often with rod-like teeth. Nucleus oval or band-like. Cilia covering the entire body, sometimes longer on the posterior border.

PRORODON TERES Ehr.

Body oval, cylindrical. Oral opening terminal, provided with minute, rod-like teeth. Nucleus spherical, centrally located; contractile vesicle in the posterior region.

Length, 150–200 microns. (Fig. 93, Pl. XII.)

This species has frequently been found in stagnant pond water. An interesting phenomenon has come under observation with reference to the division of *Prorodon teres* which takes place by transverse fission. A large individual was discovered already in the process of division, which continued until merely a narrow isthmus of protoplasm connected the two portions. Suddenly another constriction began to take place and in a few minutes a very small individual separated from the anterior extremity of the dividing organism and swam away.

In the meantime the original constriction grew deeper and deeper until but a mere thread, seemingly ready to break at any moment, remained. But division was not to take place. All at once there was a rush of endoplasm centrally from each extremity, the narrow connecting thread of protoplasm became inflated and continued to broaden until the body reached its normal proportions.

This, apparently, is a case of defeated division. Probably the small individual carried away with it the entire nucleus of the anterior half, leaving only one nuclear mass for the two dividing portions.

PRORODON EDENTATUS C. & L.

Body oval, cylindrical, equally rounded at both extremities. Oral aperture eccentric, opening into a conical tube which reaches far into the endoplasm. Cilia of the posterior border somewhat longer than those of the general surface. Nucleus spherical, central in position. Contractile vesicle posterior.

Length, 125 microns. (Fig. 94, Pl. XII.)

In general appearance this species resembles *Prorodon teres* but differs from it chiefly in the eccentricity of the mouth.

Although not common, *Prorodon edentatus* may be found in pond water and stagnant infusions.

Reproduction is by transverse fission.

TRACHELOPHYLLUM C. & L.

Elongate, flask-shaped, flattened. Anterior region narrow, neck-like, terminating in a minute conical process which is punctured by the oral aperture.

The pharynx may be traced backwards through the neck-like region. Nuclei usually more than one. Contractile vesicle posterior.

TRACHELOPHYLLUM TACHYBLASTUM Stokes.

Body elongated, flexible, somewhat clavate when fully extended, flask-shaped when contracted. Oral aperture followed by an indistinct pharyngeal passage. Cilia clothing the entire surface and vibrating in an independent manner. Nuclei two in number, spherical, not connected. Contractile vesicle in the posterior region.

Length, 175 microns. (Fig. 95, Pl. XII.)

This species is not uncommonly found in this state although it has not so far been observed to be widely distributed. Found at the bottom of old infusions of pond water, where it glides along evenly and at a rapid rate. Another form, differing from the above apparently chiefly in size, has been found in pond water in Johnson county. Some individuals have exceeded 300 microns in length. It may be identical with *Trachelophyllum vestitum* Stokes, but the external granular covering has not been apparent in the Iowa species.

DIDINIUM Stein.

Usually ovate, cylindrical, rounded posteriorly, produced anteriorly into a short conical proboscis, and bearing a posterior and anterior circle of cilia. Oral aperture puncturing the extremity of the proboscis.

DIDINIUM NASUTUM Müll.

Body oval, broadly rounded posteriorly. Anterior conical proboscis longitudinally striate. One wreath of cilia near the base of the proboscis, the other posterior to the middle of the body.

Nucleus band-like, curved, centrally located. Contractile vesicle posterior.

Length, 100–175 microns.

Figure 96, Plate XIII, represents a typical individual of this species. In its motion *Didinium nasutum* is swift, rolling on its longitudinal axis, darting from side to side, then suddenly stopping in its flight, with the anterior end downward, it whirls rapidly for a few seconds, then continues its random course.

The food habits of *Didinium nasutum* present some interesting features, the organism being found associated with *Paramœcium*, which serves as its principal food. It is fierce and aggressive, grasping its prey with the snout-like proboscis and literally gulping it down whole, the process requiring but a few seconds.

Balbiani, the French naturalist, records that the proboscis may be protruded even to the length of the body and by this means *Didinium* grasps its prey and sucks the contents or transfers it whole to its own body by the retraction of the proboscis. My observations have not verified this; in fact, at no time in the scores and scores of instances in which *Paramœcium* has been observed to become the prey of *Didinium*, was there a protrusion of the snout-like process, but the animal approached and, striking its prey with the unextended proboscis, proceeded to swallow it whole. The striking results in a paralyzing effect upon *Paramœcium*, its struggles ceasing almost immediately.

Sometimes *Paramœcium* is grasped near the middle instead of at the end, in which case *Didinium*, instead of entirely releasing its prey, by a quick, jerky movement shuffles along until one extremity of the "slipper-animalcule" is reached, then the ingestion takes place.

Figure 97, Plate XIII, is drawn from a mounted specimen fixed during the process of ingestion of *Paramœcium*.

Reproduction takes place by transverse fission, preliminary steps to constriction of the body being the elongation of the nucleus and the appearance of two supplementary wreaths of cilia.

A very definite flow of protoplasm within the body may be observed, the endoplasm flowing toward the anterior extremity along the periphery, then turning inward and uniting in a common backward stream along the longitudinal axis, separating in the posterior region, turning outward and flowing forward again.

This protoplasmic current, illustrated by Figure 98, Plate XIII, no doubt is of assistance in the rapid ingestion of food.

Didinium nasutum has been found in but two, though widely distant, regions of the state. In January, 1904, the species was taken from a small stream near Iowa City in an infusion of submerged leaves, and in August, 1905, it was found in Lake Okoboji among decaying vegetation.

MESODINIUM Stein.

Ovate or pyriform, rounded posteriorly, produced into a conical proboscis anteriorly. Oral aperture terminal, puncturing the extremity of the proboscis, at the base of which is a single circle of strong cilia.

MESODINIUM sp. (?)

Figure 99, Plate XIII, represents a species not infrequently found in the fresh waters of this state, which is conditionally referred to this genus.

Body somewhat globose, nearly as broad as long, broadly rounded posteriorly, produced into a snout-like process anteriorly. Oral aperture indistinct but apparently in the distal extremity of the proboscis. Color, green. Nucleus and contractile vesicle concealed.

Length, 35 microns.

The anterior, snout-like proboscis, which has been observed to be somewhat extensile and contractile and which is apparently punctured at its distal extremity by the oral aperture, has led me to conditionally classify the organism here. Future observations may reveal its true identity. So far as I am able to discover, no species of this genus has been reported to be densely green in color, as this organism is.

LACRYMARIA Ehrenberg.

Elongate-oval or flask-shaped, nearly cylindrical, somewhat elastic. Anterior extremity usually very narrow, neck-like and sometimes highly extensile and contractile. Oral aperture terminal, puncturing a cone-like projection, or an obliquely truncate border.

LACRYMARIA COHNII (?) S. K.

Figure 100, Plate XIII, represents a species not infrequently

found in the waters of this state which has been tentatively referred to this species. Body elongate-oval, about two and one-half times as long as broad, highly elastic. Anterior extremity continued as a short, neck-like extension. Oral aperture terminating a cone-like projection which is smaller than the neck and slightly constricted from it. The anterior extremity of the neck bearing a circle of cilia larger than those of the general surface.

Endoplasm completely filled with dark globular masses, rendering the body opaque and concealing the nucleus. Contractile vesicle posterior.

Length of body, 90 microns.

Lacrymaria cohnii is reported to be a salt-water form but the species occurring in this state is so closely allied to it that I would, at least for the time being, classify it here. The species has been found in Lake Okoboji and also in some of the eastern counties of this state. Its habitat is fresh water among aquatic plants. Movement is accompanied by rapid revolution on its longitudinal axis.

LACRYMARIA TRUNCATA Stokes.

Body elongate, somewhat flask-shaped, flattened. Rounded posteriorly, produced anteriorly into a long neck-like region, the anterior border of which is obliquely truncated and slightly dilated. Surface longitudinally striate. Cilia of the anterior extremity slightly larger than those of the general surface. Oral aperture in the anterior truncated border. Nucleus long, band-like, twisted and convoluted in the posterior region. Contractile vesicle posterior.

Length, 160 microns. (Fig. 101, Pl. XIII.)

This species may be found in long-standing infusions of pond water, the truncated anterior border and greatly convoluted nucleus serving to readily distinguish it. The organism is a rapid swimmer, rotating on its longitudinal axis.

LACRYMARIA OLOR Müll.

Body elongate-ovate, posterior extremity pointed. Anterior extensile neck capable of being extended many times the length of the body. Surface obliquely striate in two directions. Nucleus double, central. Contractile vesicles more than one.

Length, with neck contracted, 50–70 microns. (Fig. 104, Pl. XIII.)

A common and widely distributed species found in pond water. Its swan-like appearance was suggested to the early observers by its graceful movements, as it swims about extending its neck here and there in search of food.

Reproduction takes place by transverse fission.

Family, TRACHELINIDÆ.

AMPHILEPTUS Ehrenberg.

Elongate, usually flattened, with an anterior neck-like region at the base of which is the oral aperture. Nuclei usually more than one. Contractile vesicles single or numerous. Trichocysts sometimes present.

AMPHILEPTUS MELEAGRIS Ehr.

Body elongate, compressed, with a short, thick, neck-like anterior region. Mouth, a cleft-like opening near the center of the body. Nuclei, two in number, central in position. Contractile vesicles numerous. No trichocysts.

Length of body, 250 microns. (Fig. 105, Pl. XIV.)

Amphileptus meleagris has been found in pond water, also in running streams, although not an abundant species in this state. An interesting phenomenon with reference to the life history of this organism has been reported by various observers. After feeding upon a zoöid of *Epistylis* or some related species, *Amphileptus* may attach itself to the branch occupied by its victim and there become encysted, during which period division into four animalcules takes place.—Kent, "Manual of the Infusoria." Vol. II, p. 526.

A curious relation between this species and *Carchesium polypinum* which bears witness of the above phenomenon has come under my observation. During September, 1905, on examining *Carchesium polypinum* taken from a small running stream near Iowa City, numerous individuals of the species under consideration were found attached to the branches of the peritrichous colony. The posterior border of *Amphileptus* was deeply cleft and clasped the branch of its host; in addition a protoplasmic band from one of the lip-like processes passed around the branch of *Carchesium*, thereby producing a firm anchorage.

The nuclei were four in number, and of great size, occupying the greater portion of one side of the organism.

This relation, as illustrated by Fig. 102, Pl. XIII, is probably preliminary to the encystment of *Amphileptus meleagris*.

LOXOPHYLLUM Dujardin.

Flattened, leaf-like and flexible, the anterior extremity usually the narrower. Oral aperture on the left border anterior to the middle of the body. Cilia fine, in longitudinal rows. Nucleus differing in different species but often moniliform. Contractile vesicles single or multiple. Trichocysts usually present.

LOXOPHYLLUM sp. (?)

Body very elastic, central region the wider, narrowing toward each extremity. Nucleus in maturity consisting of numerous separate oval masses. Contractile vesicles numerous, scattered. Trichocysts not evident.

Length of body, 400 microns. (Fig. 103, Pl. XIII.)

The organism as described above resembles, in the character of its nucleus, *Loxophyllum meleagris* Müll. The nucleus in some individuals has been observed to be band-like while in other specimens as many as eight disconnected oval bodies are present, the latter probably representing the mature phase of the organism. Crenulation of the dorsal border has, however, not been made out in the Iowa species, nor has the presence of trichocysts been evident.

Found in the bacteria-laden film of water at the surface of pond water infusions.

Reproduction is by transverse fission.

DILEPTUS Dujardin.

Very elongate, with a narrow anterior region, neck-like and flexible, at the base of which is the mouth. Nucleus moniliform. Contractile vesicles numerous, in a dorsal row. Trichocysts present in the neck-like region.

DILEPTUS GIGAS C. & L.

Body greatly elongate, somewhat compressed, often with a pointed tail-like prolongation. Anteriorly the body is produced into a long, flattened, neck-like region, very flexible and slightly

extensile. Oral aperture at the base of the neck, often a prominent hump or shoulder indicating its position. Pharynx short.

Nucleus moniliform, extending nearly the length of one side of the body. Contractile vesicles numerous, arranged in a dorsal row nearly the whole length of the body.

Trichocysts on the ventral surface of the neck.

Length of body, 500-800 microns. (Fig. 106, Pl. XIV.)

This species is one of the most elongated free-swimming species of Protozoa common to this state. The organism is carnivorous in its food habits, smaller animalcules usually being captured by means of the trichocysts and pressed into the oral aperture by the long flexible neck. It has been my observation that the trichocysts are paralyzing in their effect upon the Infusoria, but do not necessarily produce death. *Dileptus gigas* has been seen to paralyze a small holotrichous form with its stinging threads and, in the attempt to ingest it, the victim was pushed entirely out of reach by the long neck of its captor. In a few moments the little organism revived and swam away, leaving *Dileptus* apparently frantically seeking in all directions for that which had escaped.

In young individuals the posterior region is usually broadly rounded, the tail-like prolongation being commonly observed in maturer specimens. The nucleus is usually concealed and reagents may be necessary to render it visible.

Found in pond water and widely distributed. Reproduction is by transverse fission.

LIONOTUS Wrzesniowski.

Elongated, flexible, with a flattened ciliated ventral and a convex dorsal surface. Anterior extremity usually neck-like, posterior extremity often pointed, tail-like and curved. Oral aperture ventral. Contractile vesicles sometimes numerous.

LIONOTUS FASCIOLA Ehr.

Body elongated, ciliated on the ventral surface only, wider centrally, gradually tapering toward the narrow, flexible neck-like region, the distal extremity of which is often abruptly curved. Posterior extremity rounded, narrow. Oral aperture ventral, an indistinct, slit-like opening some distance from the anterior end. Nuclei, two spherical bodies centrally located.

Contractile vesicle single, posterior. Trichocysts along the ventral surface of the neck.

Length of body, 110 microns. (Fig. 107, Pl. XIV.)

Found in great numbers in the surface film of pond water infusions among bacteria. Reproduction may often be seen to take place by transverse fission.

LIONOTUS PLEUROSIGMA Stokes.

Body elongated, wider centrally, with a long neck-like region, slightly curved, the short caudal projection often acutely pointed and curved in the opposite direction.

Oral aperture a short distance from the anterior end. Nuclei two in number, centrally located and usually connected. Contractile vesicles numerous, arranged along the ventral and dorsal borders.

Length, 80-100 microns. (Fig. 108, Pl. XIV.)

Found associated with the last described species in infusions of pond water, among bacteria. Reproduction is by transverse fission. Conjugation may often be observed, the anterior half of the ventral borders becoming temporarily united.

LOXODES Ehrenberg.

Elongated, flattened, anterior extremity presenting a hook-like appearance. Ventral surface with fine cilia arranged in longitudinal rows, dorsal surface slightly convex with no cilia. The margin of the body with a series of strong cilia. Peristome an elongate furrow in the ventral border of the anterior extremity ending posteriorly in the mouth, which opens into a more or less distinct pharynx.

LOXODES ROSTRUM Ehr.

Body persistent in shape but very flexible, posterior extremity bluntly rounded or acutely pointed and bent to the left, as the anterior end. Oral furrow followed by an indurated tube-like pharynx. Nuclei more than one. Contractile vesicles inconspicuous.

Length, 250–400 microns. (Fig. 109, Pl. XIV.)

The body of this species is usually highly vesicular, but the number and disposition of the contractile vesicles has not yet been made out.

In all forms observed in the state but two nuclei were present, they being widely separated. Smith, of New Orleans, also reports that the species of his locality possesses but two nuclei. Careful staining has failed to reveal the racemose system of nuclei as demonstrated by Wrzesniowski. It may be that the species varies somewhat in this particular.

Found in the bottom of old infusions of pond water. Movement, a gliding motion.

TRACHELIUS Ehrenberg.

Oval or elongate, elastic. Oral aperture at the base of a short flexible neck-like extension of the anterior extremity.

TRACHELIUS OVUM Ehr.

Body oval or nearly spherical, broadly rounded posteriorly, produced anteriorly into a narrow, short, but highly flexible neck-like prolongation. Oral aperture circular, leading into a short, longitudinally striated pharynx. Nucleus central. Contractile vesicles numerous.

Length, 300 microns. (Fig. 110, Pl. XIV.)

The body of this species usually presents a highly vacuolated appearance. From the inner end of the pharynx the endoplasm spreads out into four or five broadly diverging ramifications. The nucleus is band-like or oval and sometimes two independent nuclei may be seen.

Found in fresh water but not abundant. Reproduction by transverse division.

Family, CHLAMYDODONTIDÆ.

NASSULA Ehrenberg.

Body ovate, cylindrical. Mouth lateral. Pharynx a cylindrical tube, with or without rod-like teeth, usually dilated at the exterior end. Nucleus spherical. Contractile vesicles sometimes multiple. Trichocysts often present. Body brightly colored.

NASSULA ORONATA Ehr.

Body elongated, oval or elliptical, cylindrical. Pharyngeal tube composed of a number of rod-like teeth dilated at the exterior end. Nucleus large, spherical, posteriorly located. Contractile vesicle single. Usually some shade of red or brown in color.

Length, 200 microns. (Fig. 111, Pl. XIV.)

This species has been found in a number of localities in this state, Lake Okoboji having furnished some very large specimens. Usually the pharynx is made up of twelve or more rods so united together as to form a cylindrical tube slightly dilated at the exterior end.

Usually an individual exhibits a variety of colors, which probably result from the breaking down of the algæ and other plants of low order upon which it feeds. Found in fresh water. Trichocysts are not present in this species.

NASSULA RUBENS C. & L.

Body elongate, cylindrical, equally rounded at both extremities. Pharynx made up of rod-like teeth forming a cylindrical tube, dilated at the exterior end.

Nucleus spherical, posterior. Contractile vesicle single. Trichocysts very numerous.

Length, 50–80 microns. (Fig. 112, Pl. XIV.)

This species is much smaller and less abundant than the preceding one. The presence of the trichocysts will also readily distinguish it from *Nassula oronata*.

Found in fresh water associated with the last named species. Color usually some shade of red.

CHILODON Ehrenberg.

Compressed, flexible, ventral surface flattened, with cilia arranged in longitudinal rows. Dorsal surface somewhat convex, smooth. Anterior extremity projecting to the left in a lip-like manner. Oral aperture ventral, leading into an elongated, conical pharynx provided with numerous rods. Nucleus oval, posterior to the center of the body. Contractile vesicles often numerous.

CHILODON CUCULLULUS Müll.

Body elongate-oval, rounded posteriorly. Lip-like extension prominent. Oral aperture usually anterior to the middle of the body. A groove leading from the lip-like extension to the mouth. Nucleus oval, near the inner end of the pharynx. Contractile vesicles numerous, scattered.

Length, 125–200 microns. (Fig. 113, Pl. XV.)

Chilodon cucullulus is one of the common forms of stagnant water and may also frequently be found in fresh water among algæ.

Embryos of this species differ from the adult in several particulars. The body is greatly inflated and the inner end of the pharynx is usually spirally twisted, while the nucleus is small, round, and in the posterior extremity of the body. As age advances the nucleus becomes larger, more oval in outline, and occupies a position close to the inner end of the pharynx.

The common method of reproduction is by transverse division. Conjugation may often be observed. The organism feeds upon algæ, diatoms, etc., the endoplasm frequently being packed with plants of low order.

CHILODON CAUDATUS Stokes.

Body elongate-ovate, wider anteriorly, the left-hand anterior extremity produced into a prominent lip-like extension. The posterior extremity of the flattened ventral surface somewhat acutely rounded, while the posterior extremity of the dorsal surface is drawn into a short, more or less acutely pointed, tail-like appendage, which is free from the corresponding ventral extremity. Oral aperture similar to that of *Chilodon cucullulus*.

Nucleus oval, posterior to the middle. Contractile vesicles scattered.

Length, 50–75 microns. (Figs. 114-115, Pl. XV.)

This species as found in this state presents some individual variations with respect to the posterior extremity. Frequently one surface of the posterior extremity may be broadly rounded while the other surface is acutely pointed. In other individuals both dorsal and ventral surfaces may be acutely pointed.

From a lateral point of view the posterior extremity is as represented in Fig. 115, Pl. XV, the dorsal tail-like extension being entirely free from contact with the ventral portion.

The species has been found in pond water in a few localities only in this state.

Reproduction takes place by transverse fission.

CHILODON FLUVIATILIS Stokes.

Body about twice as long as broad, rounded posteriorly, the left-hand anterior border not produced into a prominent lip-like

extension. The left-hand margin of the body nearly straight. Oral system as in *Chilodon cucullulus*. Nucleus oval, posterior to the middle of the body. Contractile vesicles numerous and scattered.

Length, 75 microns. (Fig. 116, Pl. XV.)

Not a common species in this state but has been found in Johnson county, taken from a fresh water pool among algæ and other aquatic plants.

ÆGYRIA C. & L.

Body enclosed within two valves, which are united on the dorsal border. A tail-like process extending from the posterior extremity. Oral aperture ventral, a short distance from the anterior end, followed by a tube-like pharynx.

ÆGYRIA sp. (?)

Figure 117, Plate 15, illustrates a form observed but once in this state and tentatively placed under this genus.

From a lateral point of view the body is a little longer than wide, even and broadly rounded at each extremity. Right valve traversed by three longitudinal ridges. Posterior caudal projection short, thick, and bluntly rounded, directed obliquely.

Length of valves, 175 microns.

Found in pond water in Johnson county during the fall of 1903 and not observed since. As far as I have been able to determine nearly all species of this genus previously described are reported as inhabiting salt water, but the study of this fresh water form, although somewhat brief, revealed generic characters which would place it within this genus or a very close ally.

Family, CHILIFERIDÆ.

TRICHODA Müller.

Ovate, elastic, anterior extremity narrow with border obliquely truncate, rounded posteriorly. Oral aperture terminal, provided with a minute vibratile membrane. Cilia very fine.

TRICHODA PURA Ehr.

Body elongate-oval, broadly and evenly rounded posteriorly. Anterior extremity curved, narrow, and almost pointed. Nucleus

spherical, centrally located. Contractile vesicle posterior to the nucleus. Endoplasm usually transparent.

Length of body, 40 microns. (Fig. 118, Pl. XV.)

This species has been found abundantly in long-standing infusions of pond water. It is a swift moving animalcule progressing in a straight course, usually rolling on its longitudinal axis.

Reproduction takes place by transverse division.

LEUCOPHRYS Ehrenberg.

Ovate, broadly rounded posteriorly, somewhat truncate anteriorly. Peristome short and broad, harp-shaped and confined to the anterior region. Pharynx distinct. Cilia of the left-hand border of the peristome larger than those of the general surface.

LEUCOPHRYS PATULA Ehr.

Body oval, persistent in shape, the anterior extremity obliquely truncate. Peristome broadly harp-shaped. Pharynx tubular, curved. Surface longitudinally striate. Nucleus band-like, curved, centrally placed. Contractile vesicle posterior.

Length, 200 microns. (Fig. 119, Pl. XV.)

Rarely found in this state. Habitat, fresh water among algæ.

GLAUCOMA Ehrenberg.

Somewhat oval, ventral surface flattened and ciliated, dorsal surface convex, sometimes furrowed. Oral aperture on the ventral surface, provided with a vibratile membrane. Nucleus spherical. Contractile vesicle single.

GALUCOMA SCINTILLANS Ehr.

Body oval, ventral surface ciliated. Oral aperture a little distance from the anterior extremity with the vibrating membrane extending around it, presenting a bilabial appearance. Nucleus large, spherical, situated in the central region. Contractile vesicle single, in the posterior region.

Length, 75 microns. (Fig. 120, Pl. XVI.)

When viewed laterally the oral membrane protrudes as a single tongue-like process, but from a ventral view-point the bilabial character is evident, the lips usually vibrating slowly, opening and closing the oral aperture.

Found often in great numbers associated with *Chilomonas paramæcium* in pond water infusions. Reproduction by transverse division.

GLAUCOMA sp. (?)

Body with dorsal surface convex and deeply grooved in a longitudinal direction, flattened ventrally. Oral aperture indistinct. Ventral surface clothed with cilia. Nucleus spherical, central or near the dorsal border. Contractile vesicle posterior to the middle of the body. Endoplasm usually filled with green chromatophores.

Length, 50 microns. (Fig. 121, Pl. XVI.)

During the summer of 1905 a species as described above was found abundantly in Lake Okoboji as well as other localities of the state.

The position and character of the oral aperture could not definitely be determined, although what appeared to be an oral membrane was sometimes visible on the ventral surface near the anterior extremity.

Green chromatophores usually filled the organism, being arranged in longitudinal rows between the grooves, but transparent individuals free from chlorophyl have not infrequently been observed. Nucleus seldom visible without the aid of reagents.

Reproduction by transverse fission.

Found in fresh water with aquatic plants.

This species is conditionally placed in this genus.

FRONTONIA Ehrenberg.

Elongate-oval or elliptical. Oral aperture lateral, appearing as a slit-like opening. Pharynx short with minute teeth. Surface striated longitudinally. Trichocysts usually abundant.

FRONTONIA LEUCAS Ehr.

Body elongate-oval, wider anteriorly. Oral aperture anterior to the middle of the body. Cilia fine, arranged in longitudinal rows. Contractile vesicles usually two in number. Trichocysts very numerous.

Length, 250–300 microns. (Fig. 122, Pl. XVI.)

Frontonia leucas is a common form in stagnant pond water, often

associated with *Paramæcium caudatum*, and is widely distributed over the state.

Plant tissue seems to be the chief food of this species, individuals being frequently observed almost entirely filled with algæ filaments, diatoms, etc. When this variety of food is not to be obtained, however, the organism may adopt a carnivorous habit, on one occasion a large specimen having been seen to have ingested four rotifers. The anal opening is near the posterior end at right-angles to the mouth.

Trichocysts are highly developed in this species, various chemical stimuli causing them to be extended far beyond the cilia and often cast entirely from the body.

Reproduction takes place by transverse division, a new oral aperture appearing even before constriction of the cell commences. The nucleus is concealed during life and I have not been able to demonstrate its nature or position, even by the aid of stains.

Figure 123, Plate XVI, represents a species found in Johnson county among algæ, which probably should be classified under this genus. The body is palstic but usually oval and densely packed with globular food-masses. The oral aperture has not definitely been made out although a slit-like opening, lateral and anterior in position, may sometimes momentarily be seen, but immediately closes. Contractile vesicle single. The nucleus, by the aid of reagents, is found to be greatly elongated in a medium plane of the body. I have not made a sufficient study of the organism to accurately determine its identity.

OPHRYOGLENA Ehrenberg.

Somewhat oval, flattened ventrally, convex dorsally. Oral opening anterior to the center of the body, provided with a vibratile flap-like membrane. Trichocysts often present.

OPHRYOGLENA ATRA Ehr.

Body rounded anteriorly, posterior extremity pointed. Endoplasm usually dark colored and opaque with a very dark blue pigment spot in the anterior region. Nucleus round, posteriorly situated. Contractile vesicle central.

Length, 125–150 microns. Fig. 124, Pl. XVI, a ventral view

Apparently this species is not widely distributed over the state nor is it an abundant form. It has been found in stagnant pond water associated with *Paramæcium*.

Trichocysts are well developed.

LOXOCEPHALUS Ehrenberg.

Body elongate-oval, posterior border rounded, anterior border obliquely truncate and bent to one side. Near the anterior end on one or both sides of the organism are borne one or more short setæ curved forward. From the posterior border extend one or more long setæ. Oral opening in the anterior truncated border, but indistinct.

LOXOCEPHALUS GRANULOSUS S. K.

Body elongate, nearly cylindrical, the anterior extremity truncate and slightly curved, a short curved seta borne on either side of the body near the anterior extremity. One long, straight seta projecting from the posterior border. Nucleus spherical, centrally located. Contractile vesicle posterior to the nucleus. Endoplasm granular.

Length, 40–70 microns. (Fig. 125, Pl. XVI.)

Often found in great quantities in pond water among decaying vegetable matter. The oral opening is on the oblique anterior border although quite indistinct; its presence, however, may be indicated by the fact that this region is slightly protruded at times as if the mouth were being expanded.

Conjugation of this species often occurs in infusions, the oblique anterior borders being coalesced during the process. At times the usually compact spherical nucleus may be found to be separated into from four to six small, round masses lying close together in the cytoplasm. This may represent a condition following conjugation.

Reproduction takes place by transverse division.

URONEMA Dujardin.

Ovate, or elongate. Oral aperture ventral, with an extensile membrane. Cilia of general surface vibratile. One or more long setæ extending from the posterior border.

URONEMA MARINUM Duj.

Body elongate-ovate, usually more than twice as long as broad. Cilia arranged in longitudinal rows. One long seta produced from the posterior border. Oral aperture lateral with a membrane more or less elongated but not greatly extended. Nucleus central. Contractile vesicle posterior.

Length, 30 microns. (Fig. 126, Pl. XVI.)

In general contour this species somewhat resembles *Cyclidium glaucoma*, but is larger and the cilia instead of being rigid are exceedingly vibratile, their movement being irregular and independent. The oral membrane of *Uronema* is not so highly extensile as in *Cyclidium*.

Found in fresh water, often associated with *Cyclidium* but not nearly so abundant.

COLPIDIUM Stein.

Somewhat kidney-shaped, persistent in form. Oral aperture a little distance from the anterior extremity. Pharynx with a slightly protruding, undulating membrane.

COLPIDIUM STRIATUM Stokes.

Body about twice as long as broad, the anterior extremity slightly curved toward the ventral aspect. Nucleus usually central. Contractile vesicle posterior.

Length, 60 microns. (Fig. 128, Pl. XVII.)

Colpidium striatum is a common and widely distributed form found in pond water. In general appearance it resembles *Colpidium cucullus* Schrank, (not observed in this state) which, however, possesses two nuclei.

Reproduction takes place by transverse division.

COLPODA Müll.

Resembling *Colpidium* in general outline, compressed laterally. Oral aperture ventral, in a cleft-like depression. Cilia around the mouth longer than those of the general surface.

Stokes has described several species under the generic title *Tillina* which probably should be retained within the genus *Colpoda*.

COLPODA HELIA Stokes.

Body elongated, bean-shaped, both extremities evenly rounded, the anterior one curved ventrally. Oral aperture ventral, about one-third the length of the body from the anterior end. Pharynx short, curved. Nucleus oval, central. Contractile vesicle posterior, with radiating sinuses.

Length, 100–120 microns. (Fig. 129, Pl. XVII.)

Frequently found in abundance in pond water.

COLPODA SAPROPHILA Stokes.

Body somewhat semi-circular when viewed laterally, convex dorsally, flattened ventrally.

Oral aperture near the center of the ventral surface, leading into a short, curved pharynx. Nucleus near dorsal border. Contractile vesicles one or more, posteriorly situated.

Length, 30 microns. (Fig. 130, Pl. XVII.)

When undisturbed the organism usually rests on its side so that the recurved pharynx is very conspicuous. The dorsal surface obliquely striated, the ventral border of the anterior extremity being more or less deeply notched, the notches corresponding to the striations.

Reproduction, as stated by Stokes, takes place by division or by spore formation during the encysted state.

Found in infusions of pond water, but not abundant in the state.

COLPODA FLAVICANS Stokes.

Body kidney-shaped, rounded, inflated and wider posteriorly, compressed anteriorly. Convex dorsally, flattened or concave ventrally. Oral aperture near the center of the ventral surface. Pharynx short, recurved. Nucleus central. Contractile vesicle single, posterior.

Length, 65 microns. (Fig. 131, Pl. XVII.)

The species has been found in this state in damp moss taken from trees, also in hay infusions. It is not an abundant form. The endoplasm is commonly filled with spherical food-masses.

COLPODA CAMPYLA Stokes.

Body elongate-reniform, three or four times as long as broad, the anterior extremity curved slightly toward the ventral aspect,

broader posteriorly. Oral aperture ventral, near the anterior extremity; pharynx short, curved. Nucleus spherical, central. Contractile vesicle, posterior.

Length, 100 microns. (Fig. 132, Pl. XVII.)

The body of this species is more elongated and narrower than *Colpoda helia* which it most nearly resembles. It is often found in great quantities in infusions of pond water.

Reproduction is by transverse division.

COLPODA sp.

Body short, reniform, wider posteriorly. Oral aperture ventral, anterior to the center of the body. Pharynx short, slightly curved. Nucleus central. Contractile vesicle posterior with radiating sinuses.

Length, 45 microns, (Fig. 133. Pl. XVII.)

Figure 133, Plate XVII, illustrates a small species which has been observed with *Colpoda campyla*. It shows some relation to *Colpoda helia* in the radiating sinuses of the contractile vesicle at systole, but the small size would hardly permit its classification with that species.

Reproduction takes place in this minute form by transverse division.

Family, UROCENTRIDÆ.

UROCENTRUM Nitzsch.

Somewhat pyriform, with an annular furrow not far from the posterior extremity. Two girdles of cilia are present. Oral aperture ventral in a longitudinal depression. A tail-like tuft of long cilia arising from the ventral surface, posterior to the mouth, and extending some distance beyond the posterior border of the body. Nucleus and contractile vesicle in the posterior region.

UROCENTRUM TUBRO Müll.

Body wider and broadly rounded anteriorly, rounded or truncate posteriorly. Oral aperture at the juncture of the longitudinal depression and annular furrow. The posterior tuft of cilia usually brush-like. Contractile vesicle posterior with the band-like nucleus curved around it.

Length of body, 100 microns. (Fig. 127, Pl. XVI.)

The species is a common one in pond water and often produced in great numbers in infusions. In general appearance and habits this species resembles *Calceolus cypripedium* J–Clark; the latter, however, does not possess two distinct ciliary girdles.

In movement *Urocentrum tubro* proceeds in a direct course, rolling on its longitudinal axis, or swiftly darts from side to side, often dragging after it a mass of debris which has adhered to its caudal appendage.

Reproduction is by transverse division.

Family, MICROTHORACIDÆ.

MICROTHORAX Engelmann.

Somewhat oval, flattened, the dorsal surface grooved, the ventral ciliated. Oral aperture in the posterior border on the left side, provided with an undulating membrane.

MICROTHORAX SULCATUS Eng.

Body oval, flattened ventrally, convex dorsally. The dorsal surface with three longitudinal grooves. Cilia on the ventral surface only. Nucleus spherical, central. Contractile vesicle posterior to the nucleus.

Length, 40 microns. (Fig. 134, Pl. XVII.)

A very common species in this state. Found nearly everywhere in pond water, associated with *Cinetochilum margaritaceum*.

Reproduction is by transverse division.

The species observed in this state is much smaller than that reported by Engelmann.

CINETOCHILUM Perty.

Oval, flattened, dorsal surface furrowed in a spiral manner. Mouth and contractile vesicle posterior, opposite, the former with a distinct vibratile membrane. Cilia on the ventral surface, uniform, with a number of hair-like setæ projecting obliquely from the posterior region.

CINETOCHILUM MARGARITACEUM Ehr.

Body broadly oval when viewed dorsally, flattened, with a concavity in the posterior border on the left side. Oral aperture in the posterior region on the right side of the concavity and pro-

vided with a conspicuous undulating membrane. Dorsal surface spirally striated. A few long, fine setæ, extending from the posterior border in an oblique direction, one usually longer than the others. Contractile vesicle in the posterior region opposite the oral aperture. Nucleus spherical, anterior to the contractile vesicle.

Length, 30 microns. (Fig 135, Pl. XVII.)

The oral membrane of this organism vibrates rapidly and protrudes tongue-like, apparently, however, having the power to retract so that it may sometimes be invisible from a lateral point of view.

The setæ developed from the posterior border are directed toward the left and act in the capacity of a rudder, the result being that the animal does not move forward in a straight line but continually swerves to the left, often describing circles, but always turning to the left when the dorsal surface is up.

Reproduction is by transverse fission. Found everywhere in pond water.

Family, PARAMÆCIIDÆ.

PARAMÆCIUM Müller.

Elongate-oval, entirely clothed with cilia. Mouth ventral, at the posterior end of an oblique oral groove. Nucleus and contractile vesicles conspicuous. Trichocysts usually abundant.

PARAMÆCIUM CAUDATUM Ehr.

Body elongate, anterior extremity narrow and bluntly rounded, wider posteriorly. Oral groove extending from the anterior extremity obliquely backward to or beyond the center of the body. Mouth opening into a short, curved, ciliated pharynx. A tuft of longer cilia produced at the posterior tip of the body. Macronucleus and micronucleus central in position. Contractile vesicles two, one in either extremity of the body.

Length, 230 microns. (Figs. 136–138, Pl. XVIII.)

Paramæcium caudatum is perhaps the most common ciliated protozoön known. Apparently the form differs from *Paramæcium aurelia*, as recorded by Kent, only in the possession of longer cilia at the posterior tip of the body. The "long-tailed *Paramæcium*" seems to be the characteristic variety of this country; however,

Kellicott, in western New York, reports a form without the posterior tuft of cilia, which perhaps is the European variety, *Paramæcium aurelia*.

This species, by reason of its widespread distribution and abundance, is readily accessible to the student of biology and should be examined by him because some interesting phenomena are presented by it.

The gross features of intracellular digestion may readily be followed. As food particles enter the cytoplasm they are collected into minute spherical masses by the whirling motion of the current of water and each food-mass, enclosed by a film of water, is caught up by the streaming cytoplasm and slowly transported back and forth until the digestible portions have been so reduced that they can be assimilated. The indigestible material is thrown off at the anal opening, which is ventral in position, about half way between the mouth and the posterior extremity.

The position of the macronucleus, close to the inner end of the pharynx, is of no little significance, for from this point intracellular ferments can most readily be given off to the incoming food.

The contractile vesicles are distinct and often may assume a stellate appearance, especially when mechanical pressure is applied.

Temporary conjugation of individuals of the species may frequently be observed if infusions remain for some time in the laboratory. Under these conditions large numbers of individuals may suddenly enter into a state of conjugation and after remaining united for a few days the organisms quite as suddenly separate, only to repeat the process after a period of more or less duration. Fig. 137.

During the period of union of a pair some remarkable physiological changes take place which have been carefully worked out by Maupas and Hertwig. The micronucleus of each individual divides and each portion again divides, three of these parts apparently degenerate, the other again divides, one part of which remains in a state of rest, the other passes to the companion organism and fuses with the resting portion of the macronucleus there. The macronucleus then breaks up, its fragments being scattered throughout the cell, finally degenerating, the new nuclear elements being constructed from the fused micronuclear portions. Fig. 138.

The macronucleus usually begins to break up just as the organisms are about to separate, the period of nuclear reconstruction extending over many days. After a wave of conjugation had passed, on one occasion, I observed it to require from eighteen to twenty-two days for a complete reorganization of the nuclear elements. During this time no cell division takes place, the process of conjugation, therefore, acting as a check upon rather than hastening reproduction.

Of what value then is conjugation? It is believed that as a result of activity the cell becomes physiologically exhausted, some elements vital to its existence being lost which, if not renewed, will result in death to the organism. Conjugation is a means of restoring those elements lost through natural activity of the protoplasm. Calkins, however, after recent experimental work, concludes that conjugation is a means of last resort and in a state of nature probably seldom occurs.

In the natural habitat of *Paramæcium*, where conditions are changing and new elements are ever being introduced into the water from air and soil, probably there is little need for such phenomena as conjugation. The laboratory infusion, however, does not offer these changing conditions and conjugation must frequently be resorted to.

Usually, in infusions, these periods of conjugation occur after more or less regular intervals. By the introduction into the infusion of certain elements, such as animal and vegetable extracts, salts, etc., Calkins was able to revitalize *Paramæcium*, when periods of physical depression occurred, for 742 generations.

Paramæcium caudatum is abundantly supplied with trichocysts, probably defensive weapons in this species, which are coiled just beneath the cuticular suface when not in use. Stimuli of various kinds will cause these thread-like structures to shoot out far beyond the cilia, from all points of the periphery, until the body fairly bristles with them. Weak acid solutions of various kinds will cause them to be extended; often, however, if the solution be very weak, the trichocysts will appear only at the two extremities, probably indicating that these regions are the more sensitive.

Reproduction takes place by transverse division.

Found everwhere in stagnant water and infusions.

PARAMÆCIUM BURSARIA Ehr.

Body elongated, nearly twice as long as broad, rounded posteriorly, the anterior border obliquely truncate. Oral groove broad, extending backward beyond the center of the body and terminating in the mouth. Nucleus central. Contractile vesicles two in number, one in either extremity. Endoplasm usually colored green.

Length, 120 microns. (Fig. 139, Pl. XVIII.)

Normally the endoplasm of this species is crowded with green chromatophores, the chlorophyl-bearing granules near the periphery being elongated and in their appearance are not unlike a layer of columnar epithelium.

This peripheral layer is quite permanent in position, not being shifted about by the powerful endoplasmic current which is even more noticeable than in *Paramæcium caudatum*. The green coloring matter is probably a mark of age, as apparently immature individuals have been observed almost devoid of chlorophyl.

Paramæcium bursaria is a sluggish organism, not very irritable, seldom turning on its longitudinal axis but gliding along, when in motion, with the ventral surface down.

Trichocysts are well developed.

Reproduction is by transverse fission.

This species, although not a common one in this state, may be found among algæ in fresh water. Mostly solitary.

PARAMÆCIUM TRICHIUM Stokes.

Body oval, both extremities rounded, slightly flattened ventrally. Oral groove broad anteriorly, extending obliquely backward to the center of the body, ending in an oral aperture which leads into a ciliated pharynx. Nucleus oval, centrally located. Contractile vesicles two, close together in the anterior extremity of the body. Trichocysts abundant. Endoplasm transparent.

Length, 75–100 microns. (Fig. 140, Pl. XVIII.)

Found in stagnant infusions of pond water, usually appearing in the bacteria-laden film at the surface.

Reproduction is by transverse fission.

Conjugation has often been observed to take place as in *Paramæcium caudatum*.

Family, PLEURONEMIDÆ.

LEMBADION Perty.

Oval when viewed dorsally, flattened ventrally. Peristome broad and long, occupying the greater portion of the ventral surface, with a conspicuous undulating membrane on the left border. Oral aperture at the posterior end of the peristome provided with a delicate membrane. A number of rigid cilia, much longer than those of the general surface, projecting from the posterior border of the body.

LEMBADION BULLINUM Perty.

Having the characters of the genus. Nucleus elongated, curved, in the posterior region on the left side; contractile vesicle also posterior, opposite the nucleus.

Length, 50–100 microns. (Fig. 141, Pl. XIX.)

This species, on a few occasions, has been found abundantly in this state in pond water, among aquatic plants.

Normally the movement of the organism is in a direct course, but when stimulated it swims rapidly backward, rotating on its longitudinal axis. Usually from four to six posterior setæ are present.

Reproduction is by transverse division.

CYCLIDIUM Ehrenberg.

Oval, slightly compressed dorso-ventrally, persistent in form. Oral aperture ventral, with an extensile membrane. Cilia long, rigid; one or more long, hair-like setæ projecting from the posterior border.

CYCLIDIUM GLAUCOMA Ehr.

Body ovate, slightly concave on the ventral surface. Oral aperture anterior to the middle of the body, with a hood-like membrane. Cilia very long and rigid, arranged in longitudinal rows. A single posterior seta much longer than the cilia of the general surface. Nucleus central. Contractile vesicle posterior.

Length, 20 microns. (Fig. 142, Pl. XIX.)

Cyclidium glaucoma is abundant in this state in both stagnant and fresh water. Often great swarms of these animal organisms

are seen in a single drop of water, darting about and suddenly coming to rest like so many flies.

Reproduction takes place rapidly by transverse division.

CTEDOCTEMA Stokes.

Elongate-oval, cilia of the general surface long and rigid, with a longer seta projecting from the posterior border. Oral groove long and narrow with a series of long, curved setæ on the right-hand border. Oral aperture at the posterior end of the groove. Nucleus single, in the anterior region. Contractile vesicle single in the posterior region. Trichocysts abundant.

CTEDOCTEMA ACANTHOCRYPTA Stokes.

Body ovate, wider posteriorly. Cilia long, rigid, with a longer hair-like seta, curved at the distal end, projecting from the posterior border. Oral aperture at the posterior end of a shallow ventral groove which extends nearly the entire length of the body. From the right-hand margin of the groove extends a series of long rigid cilia gradually diminishing in length as they approach the oral aperture. From the left-hand margin of the groove extends a series of fine vibratile cilia also decreasing in length posteriorly. Nucleus oval in the anterior extremity of the body. Contractile vesicle posterior. Trichocysts very numerous.

Length of body, 25 microns. (Fig. 143, Pl. XIX.)

This species has been found abundantly in Johnson county among fresh water algæ. In general contour the body somewhat resembles *Cyclidium*.

On the lateral border near the posterior extremity of the body there may at times be seen a bubble-like outpushing of the protoplasm, but the ectoplasm apparently does not burst as, in a short time, the protruded portion is withdrawn, the phenomenon soon to be repeated.

The distal ends of the rigid cilia bordering the ventral groove adhere, giving the appearance under low magnification of a long, recurved seta arising from the posterior end of the groove.

Chemical stimuli may cause the trichocysts to be extended. They are stout, about 15 microns in length, and appear to be thickened at the distal end. This thickening, according to Stokes who discovered and described the species, is due to minute

linear processes, usually four, radiating from the tip of the trichocyst.

Reproduction takes place by transverse division.

Family, CYRTOLOPHOSIDÆ.

CYRTOLOPHOSIS Stokes.

Ovate, a tuft of hair-like setæ, curved distally, extending from the anterior extremity. The organism secreting, when at rest, an enveloping zone of mucilaginous substance. Oral aperture at the posterior end of a short groove on the ventral surface. A series of large cilia on the margin of the oral groove.

CYRTOLOPHOSIS MUCICOLA Stokes.

Body elongate-ovate, wider posteriorly, the anterior border obliquely truncate. Cilia of the general surface somewhat rigid, those on the margin of the oral groove longer anteriorly and diminishing in length posteriorly. Nucleus central. Contractile vesicle posterior. Mucilaginous envelope apparent when at rest.

Length, 25 microns. (Fig. 144, Pl. XIX.)

This strange form has been frequently observed in fresh water infusions among algæ and other aquatic plants. As soon as the organism comes to rest a transparent, sticky substance seems to be exuded from the body, its presence and boundaries indicated by granules of various kinds, probably partially excretory, bacteria and foreign particles of diverse nature which adhere to and become imbedded in the secretion. When disturbed the organism glides out of this covering and when it becomes quiet again another excreted zone is formed. Stokes, who has created a new family for this species, reports that the "zoöcytia" of several individuals may sometimes be united, thereby building up a temporary colony.

The prominent setæ extending from the anterior extremity are very efficient, even when the organism is at rest a powerful current of water bearing food particles being forced down the oral groove by their vibrations.

Reproduction is by transverse division.

Order, HETEROTRICHA.
Family, PLAGIOTOMIDÆ.

BLEPHARISMA Perty.

Elongate, flattened, pointed and curved to the left anteriorly, rounded or truncate posteriorly. Oral groove, a deep furrow on the left-hand border usually reaching from the anterior end to the middle of the body where it leads into a short pharynx. A series of large cilia on the left-hand border of the peristome, on the right-hand border; an undulating membrane. Color, some shade of pink or red.

BLEPHARISMA LATERITIA Ehr.

Body somewhat lanceolate, often truncate posteriorly. Peristome reaching to the middle of the body. Undulating membrane, bristle-like in appearance, sometimes not very conspicuous. Nucleus oval, in the anterior half of the body. Contractile vesicles posterior. Color, peach-bloom.

Length, 150 microns. (Fig. 145, Pl. XIX.)

Found in Lake Okoboji and a few other places of the state. Habitat, fresh water among aquatic plants. Although the organism normally possesses coloring matter, transparent individuals may often be observed. The highly-colored body also immediately becomes transparent on the application of fumes of osmic acid.

Reproduction is by longitudinal division.

METOPUS C. & L.

Usually elongate-oval, but changeable in form, anterior extremity usually twisted obliquely over the ventral surface. Oral groove narrow, furrow-like, extending obliquely from left to right nearly to the middle of the body. Oral aperture at the posterior end of the furrow, opening into a short pharynx.

METOPUS SIGMOIDES Müll.

Body usually elongate, the anterior extremity twisted over the ventral surface. Cilia covering the entire body but somewhat longer at the posterior extremity. Nucleus oval, situated centrally. Contractile vesicle posterior.

Length, 100–200 microns. (Fig. 146, Pl. XIX.)

This species is found in pond water at the bottom of old infusions of decaying vegetable matter. A variety of forms may

be assumed by the same individual; sometimes the posterior region is flattened and at times the anterior extremity lacks the obliquely twisted appearance. A form, which probably is a phase of this species, has been observed in Johnson county, with a greatly inflated posterior region and an acute anterior twisted extremity.

In the anterior extremity of the normal specimen the endoplasm usually encloses a mass of dark pigment-like granules. The motion of the organism is accompanied by a slow revolution on its longitudinal axis.

METOPIDES Quennerstedt.

Ovate or pear-shaped, usually broader anteriorly. The anterior region folded obliquely across the ventral surface. Oral furrow produced by the folded portion. Oral aperture at the posterior tip of the furrow. Cilia of oral groove large, a tuft of long setæ produced from the posterior border.

METOPIDES ACUMINATA Stokes.

Body pear-shaped, broadly rounded anteriorly, tapering toward a posterior, tail-like prolongation from which extend a number of long, slender setæ. Nucleus spherical, centrally located. Contractile vesicle in the posterior region.

Length, 75 microns. (Fig. 147, Pl. XX.)

This species differs from *Metopus sigmoides* principally in the contour of the body and the presence of the posterior tuft of long setæ. Endoplasm is usually transparent and the nucleus visible without the aid of reagents. Found in stagnant water but not abundant. In motion, rapidly rotating on the longitudinal axis.

SPIROSTOMUM Ehrenberg.

Greatly elongated but highly contractile, cylindrical, anterior border rounded, posterior border often truncate. Oral furrow extending from the anterior extremity backward to the middle of the body, the left-hand border strongly ciliate. Pharynx short. Body contracting spirally.

SPIROSTOMUM AMBIGUUM Ehr.

Body elongated, from ten to fifteen times as long as broad. Oral aperture at the posterior end of the longitudinal oral furrow. Nucleus moniliform, greatly elongated. Contractile vesicle

occupying the posterior extremity and extending forward, canal-like, nearly to the anterior end.

Length of the extended body, 500–2800 microns. (Fig. 148, Pl. XX.)

Spirostomum ambiguum, which is one of the most elongated free-swimming ciliates known, is a very common species in pond water among aquatic plants. The organism is extremely sensitive, quickly contracting into a short, spiral body on the slightest disturbance. Fig. 149.

Reproduction is by transverse division.

SPIROSTOMUM TERES C. & L.

Differing from *Spirostomum ambiguum* in the following characters: Body shorter and narrower. Oral furrow not so long in proportion to the length of the body. Nucleus oval, centrally located.

Length of extended body, 300–500 microns. (Fig. 150, Pl. XX.)

Very commonly associated with the last named species.

Family, BURSARIDÆ.

CONDYLOSTOMA Dujardin.

Ovate or elongate, cylindrical. Peristome short in proportion to the length of the body, provided with an undulating membrane and strong cilia. Nucleus moniliform, elongated. Contractile vesicles often numerous.

CONDYLOSTOMA sp.

Body elongate, cylindrical, and somewhat elastic, rounded posteriorly, posterior extremity abruptly curved toward the ventral aspect and terminating in an acutely pointed tip. Peristome, a furrow-like depression extending about one-sixth the length of the body, bearing on the right side an undulating membrane, on the left margin a series of strong cilia. Nucleus moniliform, elongated, ventral in position. Contractile vesicles more than one.

Length, 150–200 microns. (Fig. 151, Pl. XX.)

Figure 151 was taken from a fixed specimen slightly contracted, the normal individual being somewhat more elongated than is

represented by the drawing. This species is apparently distinct from *Condylostoma patens* Müll. in the general contour of the body which, in the forms observed here, has been as described above. In no case was the posterior region the widest of the two extremities and in none of the Iowa forms was a canal-like contractile vesicle present, but usually one prominent vesicle and two or three smaller ones.

Found in Jefferson county in an infusion of pond water.

UNIDENTIFIED SPECIES.

Figure 152, Plate XX, represents a species the identity of which is, as yet, undetermined. It has been observed in this state only in Johnson county, in fresh water among algæ.

Body elongate-oval, broadly rounded anteriorly, more acutely rounded posteriorly. Peristome a deep broad depression extending backward nearly to the middle of the body, bearing on the left-hand margin a row of long cilia and on the right-hand a conspicuous undulating membrane. Pharynx indistinct. Body entirely ciliated. Nucleus large, irregular in shape, central. Contractile vesicle in the posterior region, lateral.

Length, 250 microns.

None of the individuals observed at any time were brightly colored, but very transparent. The character of the oral region and nucleus would ally the form to *Blepharisma*, but the characteristic shape of the body precludes this, nor does it seem to belong to the genus *Condylostoma* on account of the nature of the nucleus.

Family, STENTORIDÆ.

STENTOR Oken.

Free-swimming or attached. When fully extended, elongate, trumpet-shaped, anterior end truncate, tapering toward a narrow foot which may be attached temporarily to some support or to the bottom of a soft, mucilaginous lorica. Anterior border bearing a spiral row of large cilia, the left-hand end of the spiral being the lower, leading into the mouth and short pharynx. Surface striate longitudinally, finely ciliate, sometimes bearing, in addition, long slender setæ. Nucleus moniliform, band-like or oval. Contractile vesicle in the anterior extremity.

STENTOR CÆRULEUS Ehr.

Body of a very large size, more or less densely blue in color. Nucleus conspicuous, moniliform.

Length of the extended body, 250–300 microns. (Fig. 153, Pl. XXI.)

In mass this species is one of the largest of fresh water Protozoa, being readily visible to the unaided eye, and often gathered in great social clusters.

Reproduction commonly takes place by oblique division of the body, the first indications of fission being the appearance on the ventral surface of an elongated vibratile membrane which soon breaks transversely into a fringe of long cilia. The anterior extremity of this fringe curls around, meeting the lower end and forming the peristomal cilia for the new individual. Separation of the body then occurs, in an oblique direction. This method is the usual one for all members of the genus and is illustrated by Figs. 154–156, Pl. XXI, which probably is another species.

Reproduction in *Stentor cæruleus* may also take place by the production of internal embryos. Probably originating from the bead-like elements of the nucleus, the embryos assume the essential characters of the adult within the endoplasm of the parent, and finally break out through the cuticular surface. This method of reproduction has been reported to occur in other species of the genus but has come under my observation only in *Stentor cæruleus*. The nucleus is usually visible without the aid of reagents, distinctly moniliform, and sometimes may be branched. The contractile vesicle is spherical, often with a conspicuous canal leading posteriorly.

A common form, widely distributed, found in old infusions of fresh water after fermentation has taken place.

STENTOR RŒSELII (?) Ehr.

Body transparent, greatly elongated when fully extended, sometimes secreting a mucilaginous sheath. Long, slender setæ often extended from the periphery. A tuft of short, fine setæ developed from the posterior extremity. Nucleus elongated, band-like.

Length, when extended, 500–1000 microns. (Figs. 154-156, Pl. XXI.)

A form not uncommon to infusions of decaying vegetation is referred conditionally to the above species. In most respects the organism corresponds to the description of *Stentor rœselii* although a mucilaginous sheath has never definitely been made out for any of the individuals observed in this state. The body is transparent throughout the life-cycle, the nucleus is never moniliform, and long slender setæ, which are retractile at will, often extend far beyond the cilia of the general surface.

The transparency of the organism together with the band-like nucleus and well developed cuticular setæ are specific characters which, I believe, exclude the form from the species *Stentor polymorphus* or *Stentor cæuruleus*.

Reproduction is as represented by Figs. 154-156, Pl. XXI, and previously described under *Stentor cæruleus*. Multiplication of this species by means of internally produced embryos has been reported by Claparede and Lachmann.

STENTOR POLYMORPHUS Müll.

Characters correspond to those of *Stentor cæruleus* except that the peripheral zone of the body is usually densely packed with green chromatophores.

Length, when extended, 500–1000 microns.

Because of its general resemblance to *Stentor cæruleus* no figure has been drawn of the species. The large size, green color, together with the moniliform nature of the nucleus, will distinguish the species from other members of the genus.

Stentor polymorphus may frequently be found in fresh water among green algæ and in the late fall often collects in great masses on the under side of rocks, in pools or small streams, where a quiescent state is passed during the winter months.

Reproduction commonly takes place by oblique fission.

Family, GYROCORIDÆ.

GYROCORIS Stein.

Anterior region helmet-shaped, rounded anteriorly, with a free posterior region. Posterior region produced into a long, curved, tail-like process. Oral aperture ventral in a ciliated groove. Cilia extending from the mouth in a spiral across the anterior border and around the free margin of the posterior region.

GYROCORIS OXYURA Stein.

Possessing the characters of the genus. Tail-like process with a broad base and even exceeding the body in length. Nucleus moniliform, short, usually composed of three bead-like masses united, and transversely placed, in the posterior region. Contractile vesicle also posterior.

Length, including caudal process, 110–150 microns. (Fig. 157, Pl. XXI.)

A rare species in this state, but found in Johnson county in pond water among decaying plants. The organism moves swiftly, rotating on its longitudinal axis.

Conjugation has often been observed to take place, the ventral surfaces of the conjugants being united.

Family, HALTERIIDÆ.

HALTERIA Dujardin.

Spheroidal, with a spiral wreath of large cilia about the anterior border. Oral aperture eccentric, on the anterior margin, the equatorial region bearing a circle of long, fine, springing setæ.

HALTERIA GRANDINELLA Müll.

Body usually somewhat spherical, truncate anteriorly, broadly or acutely rounded posteriorly. Body without cilia except the anterior wreath and the equatorial circle of springing-hairs. Nucleus oval or round, centrally located. Contractile vesicle near the nucleus. Endoplasm transparent.

Length of body, 25 microns. (Fig. 158, Pl. XXI.)

Halteria grandinella moves by a rotary motion on its longitudinal axis accompanied by frequent sudden leaps, which are said to be due to the reflex of the fine springing setæ.

The species is common to pond water and is widely distributed. It has also been found in great quantities in spring water among algæ.

Order, HYPOTRICHA.
Family, OXYTRICHIDÆ.

UROSTYLA, Ehrenberg.

Elongate-oval, very flexible. Frontal styles three or more, anal styles from five to twelve, slender and in an oblique row.

Ventral surface covered with fine cilia arranged in longitudinal rows. Peristome triangular. Nuclei usually more than one. Contractile vesicle single.

UROSTYLA GRANDIS Ehr.

Body rounded at each extremity, narrower anteriorly. Peristome triangular, reaching backward nearly one-third the length of the body, the posterior angle curved. Frontal styles numerous, scattered. Ten or twelve slender anal styles; ventral rows of cilia numerous. Marginal series of setæ complete. Nuclei usually two. Contractile vesicle on the left side anterior to the middle.

Length, 250–400 microns. (Fig. 159, Pl. XXII.)

Found in fresh water. The forms observed in this state possessed two nuclei each with a distinct micronucleus attached.

The endoplasm often presents a yellowish appearance due, probably, to the ingested diatoms and other unicellular plants upon which the organism ravenously feeds.

STICHOTRICHA Perty.

Wider posteriorly, anterior region slender, neck-like and very flexible. Peristome, a furrow leading backward to the middle of the body and ending in the mouth. Frontal styles sometimes wanting, one or more oblique rows of large ventral setæ, no anal styles. Marginal setæ forming a complete border.

Anterior half of the body often with very long, slender, hair-like setæ. Animal sometimes inhabiting a lorica.

STICHOTRICHA ACULEATA Wrzes.

Body with posterior extremity bluntly pointed. Two prominent styles extending from the anterior border, ventral setæ in two oblique rows. The anterior body-half bordered by two opposite rows of very slender hair-like setæ.

Oral furrow bordered with long, fine cilia. Nuclei two, centrally located. Contractile vesicle posterior to the mouth.

Length, 120 microns. (Fig. 171, Pl. XXIV.)

This species has been obtained from fresh water in Cedar county, but is not a common form in this state. It has not been found inhabiting a lorica or sheath of any kind, but has always been observed as a free-swimming organism.

UROLEPTUS Ehrenberg.

Greatly elongated in comparison to the width, and highly flexible; rounded anteriorly, posterior extremity extremely narrow, tail-like. Three or four frontal styles, ventral styles in two longitudinal rows; no anal styles. Marginal series of setæ set well in on the ventral surface.

UROLEPTUS RATTULUS Stein.

Body sometimes exceeding in length eight times the width, tapering from near the middle toward the acutely pointed posterior extremity, this posterior third of the body being very narrow, flexible and tail-like. Peristome short, about one-sixth the length of the body. Nuclei two in number, with the contractile vesicle between them.

Length, 500 microns. (Fig 164, Pl. XXIII.)

This species has been found in long-standing infusions of decaying vegetation, but is not a common form in this state.

Movement is by short, interrupted motions, which are characteristic also of other members of this family.

Reproduction is by transverse division.

UROLEPTUS AGILIS (?) Eng.

Body four or five times as long as broad, wider centrally, tapering posteriorly toward a narrow, bluntly rounded extremity which may be slightly turned to the right. Frontal styles four, several scattered ventral styles sometimes produced in addition to the double row. Marginal setæ forming a complete series, projecting beyond tbe border, and somewhat longer in the posterior region.

Peristome reaching nearly one-fourth the length of the body. Nuclei two in number, in the central region. Contractile vesicle on the left side a little in front of the middle.

Length, 300 microns. (Fig. 165, Pl. XXIII.)

The plate figure illustrates a form not infrequently found in fresh water in several localities of this state and which, as far as I have been able to determine, corresponds most closely to this species.

Reproduction and manner of movement as in *Uroleptus rattulus*.

PLEUROTRICHA Stein.

Elongate-oval, with from five to eight frontal styles, ventral styles usually arranged in two rows with a few scattered additional ones, anal styles five or six, two of them near the posterior border. Marginal setæ forming a complete border. Peristome extending about one-third the length of the body.

PLEUROTRICHA LANCEOLATA Ehr.

Body nearly three times as long as broad, wider centrally, tapering toward each extremity but narrowest and somewhat pointed posteriorly. Two right-hand styles arising near the posterior border and projecting beyond it for nearly their entire length. Nuclei two in number, one placed anterior to the apex of the peristome. Contractile vesicle on the left side posterior to the peristome.

Length, 250 microns. (Fig. 160, Pl. XXII.)

Somewhat resembling *Stylonychia* but possessing no caudal setæ and having the anal styles arranged in two groups.

Found in fresh water among algæ but apparently not abundant in this state.

GASTROSTYLA Engelmann.

Elongate-oval, with five or six frontal styles and usually as many anal. Ventral styles in an oblique row. The series of marginal setæ complete. Peristome triangular, curved and provided with an undulating membrane.

GASTROSTYLA STEINII Eng.

Body evenly rounded at each extremity. The three frontal styles near the anterior border very large. Three or four scattered ventral styles besides the oblique row. Five anal styles in an oblique row not projecting beyond the posterior border. Peristome extending about one-third the length of the body. Nuclei four in number in a longitudinal row. Contractile vesicle on the left side near the middle of the body.

Length, 250 microns. (Fig. 161, Pl. XXII.)

Found in fresh water.

OXYTRICHA Ehrenberg.

Elongate-oval, or elliptical, very elastic. Three or more frontal styles, a few scattering ventral setae and five anal styles. Peris-

tome about one-third the length of the body. Nuclei two. Contractile vesicle single.

OXYTRICHA PELLIONELLA Müll.

Body elongate-elliptical, wider centrally and tapering toward each extremity. The marginal setæ are set well in on the ventral surface. Three prominent frontal styles, and five anal styles arising near the posterior border and extending nearly their full length beyond it, sometimes bent at their distal ends.

Nuclei two, both posterior to the mouth. Contractile vesicle on the left side near the posterior tip of the peristome.

Length, 80-100 microns. (Fig. 167, Pl. XXIII.)

Oxytricha pellionella is one of the common species of the family found in both stagnant infusions and fresh water. The flexibility of the body is remarkable as it twists in and out among aquatic plants. In the open its movement is a short jerky motion peculiar to this and other species of the family.

Reproduction by transverse division. Distribution general.

OXYTRICHA PLATYSTOMA Ehr.

Body elongate-oval, posterior extremity slightly narrower than the anterior. Usually five frontal, three to five scattered ventral setæ and five anal styles, none of which project beyond the posterior border. Marginal setæ forming a complete series. Peristome area deep, extending about one-third the length of the body, the anterior extremity of the right-hand margin conspicuously curved to the left in a spiral manner. Nuclei two in number. Contractile vesicle on the left side, anterior to the middle of the body.

Length, 150 microns. (Fig. 168, Pl. XXIII.)

This species may readily be distinguished by the spiral nature of the right-hand margin of the peristome area, which can be distinctly seen even from a dorsal view point. The species is not common in this state. Habitat, fresh water, with other species of the genus, which it resembles in movement, manner of reproduction, etc.

HISTRIO Sterki.

Somewhat elliptical in shape, inflexible. Frontal styles from five to eight, ventral five, anal five. Marginal setæ forming a complete fringe. Peristome extending to, or nearly to, the middle

of the body. Nuclei two in number, contractile vesicle single, on the left-hand side, near the middle.

HISTRIO STEINII Müll.

Body elliptical, more than two times as long as broad, wider centrally, evenly rounded at the ends. Three prominent frontal styles with three or four additional smaller ones. Ventral styles scattered. None of the five anal styles projecting beyond the posterior border. Nuclei two, oval in form, one anterior to the mouth.

Length, 160 microns. (Fig. 166, Pl. XXIII.)

Found frequently in fresh water, and also in infusions of pond water, in many localities of the state. Reproduction is by transverse division.

STYLONYCHIA Ehrenberg.

Elongate-oval in shape, inflexible. Eight frontal, five ventral and five anal styles. Three long, hair-like setæ, usually developed from the posterior border. Peristome triangular, with a broad base and sometimes with an undulating membrane.

STYLONYCHIA MYTILUS Ehr.

Body elongate-oval, wider anteriorly, tapering toward a narrow posterior extremity. Two right-hand anal styles, large and stout, extending beyond the posterior margin. The hair-like caudal setæ very long and flexible. Peristome wide, extending nearly to the middle of the body, the inner border with an undulating membrane. Nuclei two, one anterior to the mouth. Contractile vesicle single, near the left lateral border, posterior to the peristome.

Length, 200-400 microns. (Fig. 169, Pl. XXIII.)

Stylonychia mytilus is one of the largest species of the family occurring in the waters of this state. The posterior extremity of the body is often variable in shape and character, sometimes being pointed and curved, sometimes truncated, but nearly always sharply contrasted, by its transparency, with the remaining more granular portion of the body.

Frequently the anal styles and caudal setæ present a branched appearance. Reproduction is by transverse division. Distribution is general. Found in infusions of pond water.

STYLONYCHIA sp.

Figure 170, Plate XXIII, represents a species of this genus found commonly among algæ in the fresh waters of Johnson county. So far as I have been able to determine the form does not correspond with any described species. Conn, in a recent report entitled "The Protozoa of the Fresh Waters of Connecticut," Fig. 267, Pl. 29, illustrates a species of *Stylonychia* which apparently corresponds very closely to the Iowa form as described below and may be identical with it.

Body elongate-oval, wider anteriorly, rounded posteriorly. Right-hand border convex, left-hand more or less concave, giving the body a bent appearance. Two of the anal styles extending beyond the posterior border. Caudal setæ exceedingly long and flexible.

Endoplasm often partially or completely filled with green chromatophores.

Length, 200–300 microns.

STYLONYCHIA PUSTULATA Ehr.

Body oval, about twice as long as broad, rounded at each extremity. Caudal setæ short. Nuclei two. Contractile vesicle single.

Length, 150–170 microns. (Fig. 162, Pl. XXII.)

This species is usually common in infusions of stagnant water, often developing in great numbers. Reproduction takes place rapidly by transverse fission. Movement, as in other members of the family, is a quick, jerky motion.

Distribution over the state is general.

STYLONYCHIA NOTOPHORA Stokes.

Body elongate-elliptical, rounded posteriorly, the front margin obliquely truncate on the left side, rounded or slightly concave on the right side. Five scattered ventral styles; three anal styles project beyond the posterior border. Caudal setæ long and widely separated, having their origin on the dorsal surface near the posterior margin. Peristome extending nearly to the middle of the body, the left-hand border with an undulating membrane. Nuclei two in number. Contractile vesicle single, on the left side, on a level with the posterior angle of the peristome.

Length, 120-160 microns. (Fig. 163, Pl. XXII.)

This is the rarest of the four species of the genus thus far observed in this state. It has been found in pond water, associated with other members of the family, in Cedar county. In manner of reproduction, movement, etc., it resembles other species of the genus.

Family, EUPLOTIDÆ.

EUPLOTES Ehrenberg.

Persistent in shape, inflexible, oval, ventral surface flattened, dorsal surface convex and longitudinally furrowed. From six to eight styles about the front border, a few scattered ventral ones, five anal styles and usually four large setæ on the posterior margin. Peristome extending backward to or beyond the middle of the body. Nucleus band-like, curved. Contractile vesicle in the posterior region and lateral.

EUPLOTES CHARON Müll.

Body a little longer than broad, the dorsal surface conspicuously ribbed. Seven frontal styles and three ventral. Peristome extending beyond the middle of the body.

Length, 80 microns. (Fig. 172, Pl. XXIV.)

The plate figure represents a dorsal view showing the ribbed surface. This form can usually be distinguished from the more common species, *Euplotes patella*, by the shorter oval body and the greater number of frontal styles.

Found in fresh water.

EUPLOTES PATELLA Ehr.

Body elongate-oval, evenly rounded posteriorly, truncate or rounded anteriorly. Usually six frontal and two or three scattered ventral styles. Of the four setæ on the posterior margin, two are usually somewhat lateral in position.

Peristome broad, extending nearly to the middle of the body. Nucleus band-like, curved, following the contour of the body. Contractile vesicle posterior and lateral.

Length, 150 microns. (Fig. 173, Pl. XXIV.)

This is the most common species of the genus to be found in this state and one in which individual variation is shown to a remarkable degree. Frequently the setæ of the posterior border,

the anal styles and some of the frontal styles, are observed to be frayed or broken up into brush-like fascicles. The dorsal surface may or may not be longitudinally ribbed, this feature, apparently, not being so constant as in *Euplotes charon*.

Reproduction takes place rapidly by transverse division. Conjugation also frequently occurs in infusions.

EUPLOTES CARINATA Stokes.

Body somewhat oval, evenly rounded at the extremities and the right lateral border. Left-hand border obliquely truncate in two directions, forming a projecting angle. Seven frontal styles, two or three ventral ones, five anal styles and four caudal setæ, two close together near the posterior border and two more lateral in position toward the left. Peristome extending nearly to the middle of the body. Dorsal surface usually furrowed. Nucleus band-like, curved. Contractile vescicle posterior to the middle and somewhat lateral.

Length, 60 microns. (Fig. 174, Pl. XXIV.)

A rare form in the waters of this state. Found in pond water among decaying vegetation, from Washington and Monroe counties.

ASPIDISCA Ehrenberg.

Oval or rounded, persistent in form, convex and usually furrowed dorsally, flattened ventrally. Frontal, ventral and anal styles present, from five to twelve of the latter. No caudal setæ. Peristome in the posterior region, in the left-lateral border. Nucleus band-like, curved. Contractile vesicle single.

ASPIDISCA COSTATA Duj.

Body somewhat rounded from a dorsal or ventral point of view. Convex dorsal surface with five or six longitudinal furrows. When veiwed dorsally the left postero-lateral region produced into a triangular, lip-like extension, indicating the oral region. Usually three frontal styles, four or five scattered ventral and five anal styles. Nucleus band-like, curved. Contractile vesicle usually in the posterior region, slightly lateral.

Length, 35 microns. (Figs. 175–176, Pl. XXIV.)

Aspidisca costata is found almost everywhere in infusions of pond water. The oral aperture is covered by the projecting lip-

like extension. This species presents some peculiarities in its habit of movement, never seeming at ease unless it is clambering around and around on a minute particle of plant tissue. When it loses its hold upon its support it rolls and tumbles at random through the water until it comes in contact with some other support.

Reproduction is by transverse fission

Order, PERITRICHA.
Family, VORTICELLIDÆ.

GERDA C. & L.

Elongate, cylindrical, highly contractile, not attached to but resting upon some support. Oral aperture on the anterior border, eccentric, opening into a distinct pharynx. A series of strong adoral cilia in a spiral fringe about the central, elevated, ciliary disc, one extremity of the series descending into the oral opening.

GERDA GLANS C. & L.

Body about four times as long as broad when fully extended, surface transversely striated. Pharynx greatly developed. Nucleus band-like, longitudinally placed. Contractile vesicle posterior, with canals directed anteriorly.

Length when extended, 150 microns. (Fig. 177, Pl. XXV.)

Gerda glans has been found in one locality only in this state, in Johnson county, among algæ. The individuals are usually isolated and rest upon the plant tissue for support, but are not attached to it. Reproduction takes place by longitudinal division.

SCYPHIDIA Dujardin.

Elongate, cylindrical, contractile. Posterior extremity narrow, with a suctorial border, by means of which it is attached to some support. Surface smooth or furrowed. Oral system similar to that of *Gerda*.

SCYPHIDIA INCLINANS D'Udk.

Body wider centrally, highly contractile. Ciliary disc elevated obliquely, pharynx conspicuous. Surface smooth.

On contraction the body is bent to one side and slightly shortened.

Length when extended, 85 microns. (Figs. 178–179, Pl. XXV.

This organism is solitary in its habits and has rarely been observed in this state. Habitat, fresh water among algæ. When contracted the peristome is tightly closed and a small conical process appears in the central region of the anterior margin; at the same time the body is thrown on its side, the concave surface being folded.

SCYPHIDIA sp.

Body elongate, cylindrical, contractile, wider anteriorly, gradually tapering toward the narrow posterior extremity. Ciliary disc slightly elevated. Posterior half of the body furrowed transversely, anterior half smooth. Contractile vesicle anterior. Body pyriform when contracted.

Length of extended body, 50–75 microns. (Figs. 180–181, Pl. XXV.)

This species above described and referred to this genus has been found in Poweshiek county. Habitat, fresh water. So far as can be determined, I find no described species corresponding to the funnel-shaped contour and posterior transversely striated region of this organism.

VORTICELLA Linnæus.

Body more or less bell-shaped, attached by an elongate, contractile stalk. Peristome usually prominent. A series of strong cilia encircle the central elevated region or ciliary disc, the right extremity of the series descending into the oral opening, which is eccentric in position between the peristome and the ciliary disc. Pharynx usually conspicuous. Nucleus band-like, curved. Surface smooth or transversely striate. Contractile vesicle in the anterior region.

All members of this genus are similar in general features, making it somewhat difficult to recognize separate species. However, variations of the form of the bell, and the character of its surface, positions of the ciliary disc, size and length of the stalk, are characters which are of assistance in distinguishing one species from another. Although many forms are social to a remarkable degree, colonies are never built up, longitudinal fission resulting in the complete liberation of one-half of the dividing zoöid. The separated individual having previously developed a posterior

wreath of cilia, swims away and settles down, developing a stalk of its own. Thus the cycle of life repeats itself.

When conditions are unfavorable normal individuals may develop a posterior circle of cilia, break from their pedicels and swim away to form another stalk under more favorable surroundings.

Conjugation in this group consists of a permanent union of two individuals, the larger, attached macrogamete and the smaller free-swimming microgamete, which attaches itself to the body of the stalked form. On one occasion, as observed by the writer, the complete absorption of the microgamete required eight hours.

VORTICELLA CAMPANULA Ehr.

Body broadly campanulate, greatly dilated anteriorly, surface smooth. Stalk thick, usually five or six times the length of the body. Endoplasm dark granular, often opaque.

Length of body, 150 microns. (Fig. 182, Pl. XXV.)

A common species in pond water, also found in great social groups on the under side of stones, leaves, etc., in small running streams. The collared flagellate, *Monosiga steinii*, is often attached to the pedicle of this species.

VORTICELLA NUTANS Müll.

Body campanulate, dilated anteriorly, surface smooth. Stalk slender, three or four times as long as the body. Endoplasm usually transparent. During extension the body is recurved toward the base of the stalk.

Length of body, 80 microns. (Fig. 183, Pl. XXV.)

Found in pond water in social groups.

VORTICELLA ALBA From.

Body oval, wider centrally, anterior border not greatly dilated, surface smooth. Stalk short, about three times the length of the body. Endoplasm transparent.

Length of body, 55 microns. (Fig. 184, Pl. XXV.)

Found in social groups in pond water.

VORTICELLA LONGIFILUM S. K.

Body elongate, anterior border not widely dilated. Surface smooth. Stalk slender, from twelve to fifteen times the length of the body.

Length of body, 60 microns. (Fig. 191, Pl. XXVI.)
Found in pond water, solitary in its habits.

VORTICELLA TELESCOPA S. K.

Body conical, elongate, tapering posteriorly. Two annular grooves in the posterior region, behind each of which the body abruptly narrows. On contraction the narrow regions are telescoped into the wider anterior regions. Surface smooth.

Stalk not much longer than the body.

Length of body, 40–50 microns. (Fig. 185, Pl. XXV.)

Found in Washington county, in pond water. Solitary in its habits.

VORTICELLA CITRINA Ehr.

Body campanulate, anterior border greatly dilated, surface smooth. Endoplasm pale yellow in color. Stalk slender, three or four times the length of the body.

Length of body, 60 microns. (Fig. 187, Pl. XXVI.)

Found in great social groups in fresh water.

VORTICELLA QUADRANGULARIS (?) S. K.

Figure 188, Plate XXVI, illustrates the largest species of *Vorticella* that has been observed in this state. Body greatly elongated, fully three times as long as broad, angular in contour, anterior margin slightly dilated. Pharynx very large and conspicuous. Surface transversely striate. Stalk thick and short, about twice the length of the body.

Length of body, 200 microns.

The form illustrated is classified here with some doubt as to its true identity. The organism was found in fresh water. Solitary in its habits.

VORTICELLA sp.

Figure 192, Plate XXVI, represents a species rarely found in this state. Body somewhat spherical when extended. Anterior border dilated to a considerable degree. Surface striate transversely. Stalk slender, three or four times as long as the body.

Length of body, 50 microns.

Habitat, fresh water, in small social groups.

VORTICELLA FLUVIATILIS From.

Body ovate, truncate anteriorly, with a deep concave depression in the anterior border, where the stalk is produced. Surface smooth. Stalk three or four times the length of the body.

Length of body, 40 microns. (Fig. 186, Pl. XXVI.)

Habitat, fresh water. Solitary in habits. Observed in Keokuk county.

VORTICELLA CONVALLARIA Linn.

Body elongate, twice as long as broad, conical, slightly dilated anteriorly. Surface transversely striate. Stalk four or five times as long as the body.

Length of body, 100 microns. (Fig. 190, Pl. XXVI.)

Social in habits. Found in infusions of pond water. The pedicle of this species is frequently the support for the collared flagellate, *Monosiga steinii*.

VORTICELLA ELONGATA From.

Body elongate, two and one-half times as long as broad, wider anteriorly, with margin slightly dilated. Surface transversely striate. Stalk short, not often more than twice the length of the body.

Length of body, 80 microns. (Fig. 189, Pl. XXVI.)

Habitat, stagnant water. Solitary in habits.

VORTICELLA sp.

Figure 193, Plate XXVI, illustrates a very small species of *Vorticella* sometimes found in this state.

Body elongate-ovate, wider centrally, anterior border slightly dilate. Tapering from the middle to the narrow posterior extremity. Surface smooth. Endoplasm transparent. Stalk slender, about three times the length of the body.

Length of body, 30 microns.

Habitat, stagnant water. Solitary.

CARCHESIUM Ehrenberg.

Resembling *Vorticella* but forming branched colonies with a common pedicle, the central muscle fibre being interrupted at the union of the stalk of each zoöid and the branch allowing the zoöid and its pedicle to contract independently.

CARCHESIUM POLYPINUM Linn.

Bodies somewhat pyriform, the anterior border dilated. An erect common pedicle, bearing many branches at its extremity, to which in turn are attached the pedicles of the individual zoöids. Surface of bodies smooth. Nucleus band-like, curved.

Length of zoöids, 50 microns.

Height of colony, 3,000 microns. (Figs. 194–196, Pl. XXVII.)

Figure 194 represents but a small fragment of a colony of this species. In some instances these tree-like clusters are built up to a height exceeding an eighth of an inch and contain several hundreds of zoöids.

Figure 195 illustrates a single zoöid of this species.

From a physiological point of view *Carchesium polypinum* is of no little interest. It is known what an essential part the nucleus plays in the normal activities of the living cell and in this species is illustrated the effect upon the nuclear elements of imperfect nutrition.

Miss M. Greenwood, in *The Journal of Physiology*, Vol. XX, pp. 427–454, sets forth the morphological elements enclosed by the nuclear membrane of the nucleus of *Carchesium polypinum* as being the "nucleochyme" or fluid medium, the "microsomes" or small granule-like bodies densely scattered through the "nucleochyme" and the "macrosomes" or larger masses, deeply staining with certain dyes usually oval or rounded and which may be scattered or arranged in a median line throughout the length of the curved nucleus. Miss Greenwood found that after feeding *Carchesium* on an insoluble substance such as boiled white of egg the usually deeply and uniformly staining macrosomes took on a vacuolated appearance, some of them being represented by mere shells with clear interiors. The conclusion drawn by Miss Greenwood was that the normal activity caused a drain on the organism which was not offset by sufficient repair, due to the lack of nutrition, the result being shown in the more fluid character of the macrosomes.

Somewhat similar phenomena with respect to the nucleus of *Carchesium polypinum* has come under my observation. Late in December, 1904, individuals of this species were obtained from the under side of stones in a pool near Iowa City. They appeared as minute white masses, just visible to the unaided eye, and when

taken from the ice-water were and probably had been for a long time in a state of inactivity.

On fixing and staining these individuals it was found that the macrosomes were condensed into rounded masses, usually from six to twelve being arranged in a median row throughout the length of the nucleus. Moreover, the macrosomes were highly vacuolated, Figure 196 being drawn from a permanent preparation.

It is probable that these individuals, taken from such an environment as they were, had received little or no nutrition for some time, the physiological result of this loss being manifested in the vacuolated and more fluid condition of the macrosomes.

Sometimes *Carchesium polypinum* is the temporary host of *Amphileptus meleagris*, as before described. The habitat of *Carchesium polypinum* is fresh water, often being found in running streams, attached to the under side of rocks, leaves, etc.

EPISTYLIS Ehrenberg.

Zoöids somewhat similar to *Vorticella*, usually forming a dichotomously branched colony, with a stout non-contractile stalk.

EPISTYLIS FLAVICANS Ehr.

Zoöids campanulate, greatly dilated anteriorly when extended. Five or six circles of strong cilia about the ciliary disk. Stalk dichotomously branching and rigid, at least in the young forms. Bodies usually pale yellow in color, transversely striate. Nucleus band-like, curved.

Length of zoöids, 200–350 microns.

The zoöids of this species are among the largest and perhaps the most strongly ciliated of the genus.

Figure 202, Plate XXVIII, illustrates a colony with a rigid, erect pedicle, and but two zoöids, which indicates a very young stage. In old forms the stalk loses its rigidity and the whole colony falls down in a tangled mass. Kent reports that lack of food will transform an erect colony into a decumbent one within a few hours, and specimens taken from fresh water near Iowa City in the early winter were all in this condition, probably due to the same cause.

Reproduction by longitudinal fission continues even after the

colony falls down, the physiological condition apparently resulting in a weakening of the supporting pedicels and branches. Fig. 203, Pl. XXVIII, from a prepared mount, shows the ciliary convolutions of the oral system. As in other colonial forms of this family the zoöids may develop a posterior wreath of cilia, break away from their pedicles and, each leading an independent life for a time, may ultimately settle down in more favorable conditions and begin the development of a new colony.

The species is not uncommon in the waters of this state, usually found abundantly in small running streams or fresh water pools, attached to leaves, sticks, rocks, etc.

EPISTYLIS ARTICULATA From.

Zoöids elongate, dilated anteriorly, tapering toward the posterior extremity; surface smooth. Stalks short and stout, longitudinally striate, dichotomously branching, with an articulation near the middle of the main pedicle and sometimes one or two between each bifurcation of the branches.

Length of zoöids, 42 microns.

Figure 197, Plate XXVII, represents this species, being a young colony with two zoöids. Figure 198 illustrates the colony in the process of growth by longitudinal division, the zoöids being contracted.

Figure 199 pictures a single zoöid in a contracted state, oval in form, with a concave depression in the anterior border, but lacking the annular furrows of the posterior region which are present in *Epistylis plicatilis*. The colonies are small, containing not more than a dozen zoöids, and the more frequent number is from four to six.

Found in Johnson county, attached to rocks in a small running stream.

EPISTYLIS PLICATILIS Ehr.

Zoöids elongate, conical, with anterior border dilated and ciliary disc elevated. Surface smooth; when contracted, deep annulations occur in the posterior region while the anterior border is often drawn into a minute cylindrical process. Stalk slender, dichotomously branched, secondary divisions very long.

Nucleus band-like, curved.

Length of zoöids, 75–100 microns. (Figs. 200–201, Pl. XXVIII.)

Epistylis plicatilis is one of the abundant species of this genus found in running streams and fresh water pools in Johnson county. It may be found on the under side of stones, leaves, etc., often associated with *Epistylis articulata*. The suctorian *Podophrya quadripartita* may be attached to the branches of this species in great numbers; also specimens observed by the writer bore another minute species of *Epistylis* not illustrated and not identified.

Figure 200 represents a portion of a colony. Figure 201 represents a single zoöid contracted.

VAGINICOLA Lamarck.

Body elongate, somewhat cylindrical, inhabiting a vase-shaped lorica. Ciliary and oral systems similar to those of *Vorticella*.

Lorica transparent and sessile.

VAGINICOLA sp.

Lorica cylindrical, not quite twice as long as broad, wider and broadly rounded posteriorly. Anterior extremity truncate, with a conspicuous, cleft-like notch in the margin. Character of body undetermined.

Length of lorica, 120 microns. (Fig. 204, Pl. XXVIII.)

Members of this genus are apparently rare in this state, the individual figured being the only one observed, and that under conditions which prevented a study of the extended body. The organism was fixed with other Infusoria before it came under my observation. Two contracted bodies indicates that longitudinal division had recently occurred, both individuals being yet within the lorica.

Found in Johnson county. Habitat, fresh water, among algæ.

COTHURNIA Ehrenberg.

Body as in *Vaginicola*, inhabiting a lorica with a short stalk.

COTHURNIA IMBERBIS Ehr.

Length of lorica about one and one-half times the breadth, wider posteriorly, the anterior border evenly truncate. Stalk short. Body, when fully extended, projecting but little beyond the margin of the lorica. Nucleus band-like, short and curved.

Length of lorica, 100 microns. (Fig. 205, Pl. XXVIII.)

A very short stalk is present in this species, sometimes slightly curved, but often represented only by a knob-like process.

This species differs from *Cothurnia ovata* chiefly in the slightly everted margin of the lorica of the latter and the greater extension of the body. In *Cothurnia imberbis* the dilated ciliary border is barely pushed beyond the margin of the lorica.

Reproduction takes place by longitudinal division, the daughter-cell being shown in the plate figure in a contracted condition.

Found in fresh water, attached to aquatic plants. Distribution is very general.

COTHURNIA CURVA Stein.

Lorica about twice as long as broad, anterior extremity slightly curved. Stalk short and thick, sometimes curved. Lorica transparent or opaque. Body slender, extending but little beyond the margin of the lorica.

Length of lorica, including stalk, 110 microns.

The opaque phase of the lorica represented by Fig. 206, Pl. XXVIII, indicates the mature form and is usually reddish-brown in color. Transparent or young individuals are often associated with the adult specimens. Found in fresh water, but not so abundant as *Cothurnia imberbis*.

Sub-class, SUCTORIA.
Family, PODOPHRYIDÆ.

SPHÆROPHRYA C. & L.

Usually spherical, with capitate tentacles produced from all parts of the periphery. Never producing a stalk. Sometimes parasitic within other Protozoa.

SPHÆROPHRYA MAGNA Maupas.

Body spherical. Tentacles scattered irregularly over the surface. Endoplasm granular. Nucleus spherical. Contractile vesicle usually single.

Diameter of body, 36 microns. (Fig. 207, Pl. XXIX.)

Found in diatomaceous ooze from a small stream in the vicinity of Iowa City. The tentacles, which are usually equal in length to the diameter of the body, are effectively used to catch small,

free-swimming ciliates, transferring their contents to the Suctorian's body by means of the central axial protoplasmic current.

Reproduction takes place by transverse division, and on one occasion an internal embryo was observed to break from the parent body, being entirely ciliate, but so minute and rapid in its movements that no satisfactory study of it could be made.

PODOPHRYA Ehrenberg.

Spherical, oval or elongated pear-shaped. Usually attached by a rigid stalk. Tentacles mostly capitate either in fascicles or distributed irregularly over the periphery. Nucleus and contractile vesicles conspicuous.

PODOPHRYA FIXA Müll.

Body spherical, attached by a slender but rigid stalk. Tentacles capitate, slender, and scattered over the surface of the body, often not greater in length than the diameter of the body. Nucleus oval, central or sub-central. Contractile vesicles sometimes two in number.

Diameter of body, 55 microns. (Figs. 208–210, Pl. XXIX.)

Found in fresh water among algæ, usually attached to aquatic plants by means of the stalk, which rarely exceeds in length the diameter of the body. When the water becomes slightly stagnant the individuals rapidly pass into the encysted state, the cyst being very characteristic of the species. Beginning with the stalk itself the outer surface gradually becomes indurated and sharp annular ridges make their appearance, there being from four to six in the complete cyst. The pedicle in the completely encysted form has assumed the appearance of a short, curved, caudal appendage.

Reproduction commonly takes place by transverse division. Fig. 208 illustrates a normal individual. Fig. 209 represents the beginning of the encystment, while Fig. 210 pictures the completed cyst. Small holotrichous forms serve as the principal food of this organism.

PODOPHRYA QUADRIPARTITA C. & L.

Body elongate, pear-shaped, the anterior extremity produced into four lobe-like regions from each of which proceeds a fascicle

of capitate tentacles. Posteriorly the body gradually tapers toward the point of attachment to the pedicle. The pedicle is slightly expanded at the point of union with the body. Nucleus elongate or oval. Contractile vesicles usually more than one.

Length of body, 100–200 microns. (Figs. 211–213, Pl. XXIX.)

This species has been found abundantly, attached to *Epistylis plicatilis*, which has been obtained from the under side of stones in small running streams. *Podophrya quadripartita* may also be found attached to other species of *Epistylis*. The pedicle is four or five times the length of the body and in appearance closely resembles a branch of the host which serves as its support. With the body of the Suctorian extending slightly beyond the border of the zoöids of the *Epistylis*, it can readily be seen that some minute organisms, drawn by the powerful currents produced by the zoöids of the Vorticellan, may find lodgment against the suckers of *Podophrya*.

Figure 211 illustrates a typical normal individual. Fig. 212 represents a branch of *Epistylis* with several individuals of this species attached.

Reproduction takes place by the development and liberation of internal embryos. Fig. 213 is reproduced from an individual killed with osmic acid and stained with carmine, showing what is probably an internal embryo previous to its extrusion.

Family, ACINETIDÆ.

ACINETA Ehrenberg.

Body inhabiting a lorica which is produced posteriorly into a rigid stalk. Tentacles capitate, in groups or scattered.

Two species have been observed in this state, neither of which I have been able to identify.

ACINETA sp.

Lorica spherical, produced anteriorly into a short, thick stalk. Body spherical, almost completely filling the lorica. Tentacles in two antero-lateral groups. Nucleus spherical, central. Contractile vesicle single, lateral.

Height of the lorica, 78 microns. Fig. 214, Pl. XXIX.)

Found in fresh water in Johnson county. Stalk shorter than the diameter of the body.

ACINETA sp.

Lorica somewhat spherical, produced posteriorly into a stalk which exceeds in length the diameter of the body. Body in close contact with the inner surface of the lorica. Four groups of capitate tentacles. Nucleus spherical, central. Contractile vesicle single.

Height of the lorica, 120 microns. (Fig. 215, Pl. XXX.)

Found in fresh water in Johnson county. Each fascicle of tentacles arises from a base which is apparently an outpushing of the body through an opening in the lorica.

HALLEZIA Sand.

Sand founded this genus chiefly upon the following characters: No lorica or stalk, sessile. Tentacles confined to the anterior end.

HALLEZIA BUCKEI S. K.

"Body elongate, slender, sub-cylindrical, bearing two antero-lateral fascicles of distinctly capitate tentacles; not possessing a distinct pedicle, but affixed basally by a simple contracted sucking disc; contractile vesicle anteriorly located; endoplasm subcentral.

"Dimensions unrecorded. Habitat, fresh water."

The above description is from Kent's "Manual of the Infusoria," p. 822.

PODOPHRYA COMPRESSA Nutting.

"Body illoricate, quadrate, wider anteriorly; length from two to five times the greatest width; compressed, about three times as wide as thick; the antero-lateral corners occupied by rounded prominences each bearing a fascicle of many suctorial tentacles which, when fully extended, are more than half the length of the body and spiral or spirally marked when retracted; posterior portion of the body rapidly narrowing to meet the very short, thick pedicle, which is furnished with a sucking disk at its distal end; parenchyma densely and evenly granular; contractile vesicle single, anterior; endoplast oval.

"Length of body, 1-277" to 1-140". Habitat, fresh water."

This description is taken from *The American Naturalist;* Vol. XXII, p. 13.

The chief difference between *Podophrya buckei* S. K. and *Podophrya compressa* Nutting is in the shape of the body. Sand has found all transitional forms between the cylindrical and greatly compressed body and therefore concludes that *Podophrya buckei* S. K. and *Podophrya compressa* Nutting are identical. For the reception of this and closely allied forms he has instituted the genus *Hallezia* and the species described above is known as *Hallezia buckei* S. K.

Since the Iowa form described by Nutting was of the compressed variety, and the species not having come under my observation, Figs. 216–218, Pl. XXX, are reproduced from *The American Naturalist*. Fig. 216 is a view of the broad side of the organism, while Fig. 217 illustrates the form from a lateral view point. Fig. 218 represents the beginning of reproduction, the tentacles being retracted and the internal embryos forming, which are finally extruded. Each embryo becomes a free-swimming organism for a period and then, settling down, attaches itself and rapidly developes into the adult.

For a detailed study of the species, its habits and life history, see *The American Naturalist*, Vol. XXII, p. 13.

Family, DENDROSOMIDÆ.

TRICHOPHRYA C. & L.

Irregular in shape, ovate or elongate. Tentacles usually distinctly capitate, scattered or in groups. No supporting stalk or lorica present.

TRICHOPHRYA SINUOSA Stokes.

Body irregular in shape, with marginal lobes. Tentacles long, capitate, extending in clusters from the lobes. Nucleus band-like, with ramifying branches. Contractile vesicles one or more.

Length of body, 155–200 microns. (Fig. 219, Pl. XXX.)

This species, first discovered by Dr. Stokes of New Jersey, has been observed in several localities in Iowa, being found in fresh water among algæ and other aquatic plants.

The organism is somewhat amœba-like, the marginal lobes, of which there may be as many as nine, having in some degree the power of extension and contraction resembling lobose pseudopodia

without a differentiation between endoplasm and ectoplasm. From these lobes are thrust out, often to a great distance, slender and distinctly capitate tentacles.

Dr. Stokes did not observe the nucleus, which is usually invisible without the aid of reagents. It is, however, band-like, with its ramifying branches extending toward and even into the bases of the marginal lobes. In these regions metabolic changes probably take place rapidly, since the protoplasm within the lobes may readily be seen to be in violent agitation as the tentacles are extended and withdrawn. In *Trichophrya sinuosa* there is what seems to be an example of the disposition of the nucleus of the animal cell where it can best influence metabolism. The specimens observed in this state were much greater in size than the dimensions given by Dr. Stokes.

SOME PUBLICATIONS

Of Value to One Pursuing a Systematic Study of the Protozoa.

Butschli—Protozoa. In Bronn's Klassen und Ordnungen des Thierreichs - - - - - - 1883–1888

Calkins—The Protozoa - - - - - - - 1901

Conn—A Preliminary Report on the Protozoa of the Fresh Waters of Connecticut - - - - - - 1905

Kent—A Manual of the Infusoria - - - 1880–1882

Note—The classification employed by Kent is not accepted now.

Leidy—North American Rhizopods - - - - 1879

Palmer—Delaware Valley Forms of Trachelomonas - 1905

Roux—Faune Infusorienne Des Eaux Stagnantes Des Environs De Genève - - - - - - - 1901

Stokes—A Preliminary Contribution Toward a History of the Fresh Water Infusoria of the United States 1888

INDEX.

A

	PAGE		PAGE
Acanthocystis	8	Anisonema	47
Acineta	116	Anthophysa	33
Acinetactis	32	Aphrothoracida	5
Acinetidæ	58	Arcella	16
Actinophrys	23	Arcellidæ	6
Actinosphærium	24	Ascoglena	30
Ægyria	74	Aspidisca	104
Amœba	8	Assulina	22
Amœbida	5	Astasia	45
Amœbidæ	6	Astasiidæ	30
Amphileptus	67	Atractonema	30

B

Blepharisma	90	Bursaria	56
Bodonidæ	29	Bursaridæ	56

C

Campascus	7	Cochliopodium	19
Carchesium	109	Codosiga	34
Centropyxis	18	Colacium	30
Cephalothamnium	29	Coleps	59
Cercobodo	28	Colpidium	79
Cercomonas	28	Colpoda	79
Chalarathoracida	6	Condylostoma	92
Chiliferidæ	54	Cothurnia	113
Chilidon	72	Craspedomonadidæ	29
Chilomonas	50	Cryptoglena	44
Chlamydodontidæ	54	Cryptomonadidæ	31
Chlamydomonadidæ	31	Cryptomonas	51
Chlamydomonas	51	Ctedoctema	88
Chlamydophorida	5	Cyathomonas	31
Chloropeltis	40	Cyclidium	87
Choanoflagellida	27	Cyphoderia	20
Chrysomonadidæ	30	Cyrtolophosidæ	55
Ciliata	53	Cyrtolophosis	89
Cinetochilum	82	Cystoflagellidia	27
Clathrulina	26		

D

Dallasia	55	Dileptus	68
Dendrosoma	58	Dinamœba	12
Dendrosomidæ	58	Diniferida	28
Desmothoracida	6	Dinoflagellidia	27
Didinium	63	Distigma	45
Difflugia	12		

E

Enchelinidæ..... 54
Enchelyodon 61
Entosiphon..... 48
Epistylis 111
Euglena..... 36
Euglenida 28
Euglenidæ..... 29
Euglypha..... 21
Euglyphidæ..... 6
Euplotes.....103
Euplotidæ..... 57
Eutreptia..... 29

F

Flagellidia..... 27
Frontonia..... 76

G

Gastrostyla 99
Gerda 105
Glaucoma 75
Glenodinium..... 31
Gromia..... 7
Gromidæ..... 7
Gymnodinium 31
Gyrocoridiæ..... 56
Gyrocoris..... 95

H

Hallezia 117
Halteria..... 96
Halteriidæ,..... 56
Heliozoa..... 5
Heteromastigida..... 28
Heteromita..... 35
Heteromonadidæ..... 28
Heteronema 46
Heterophrys..... 7
Heterotricha..... 53
Hexamitus..... 29
Histrio 100
Holophrya..... 60
Holosticha..... 57
Holotricha. 53
Hyalodiscus 6
Hyalosphenia..... 6
Hypotricha..... 53
Infusoria 53

L

Lacrymaria..... 65
Lembadion 87
Leucophrys..... 75
Lionotus..... 69
Loxocephalus..... 78
Loxodes..... 70
Loxophyllum..... 68

M

Mallomonas 49
Mastigamœba,..... 31
Mastigophora..... 27
Menoidium..... 30
Mesodinium 65
Metopides 91
Metopus..... 90
Microglena 31
Microgromia..... 7
Microthoracidæ..... 55
Microthorax..... 82
Monadida 27
Monas..... 28
Monosiga..... 35

N

Nassula..... 71
Nebela 6
Nephroselmis..... 49
Notosolenidæ..... 30
Notosolenus 48

O

Ochromonas..... 30
Opercularia..... 58
Ophryoglena..... 77
Opisthodon 54
Oxytricha 99
Oxytrichidæ..... 56

P

Pamphagus..... 20
Paramæcidæ..... 55
Paramæcium..... 83
Pelomyxa..... 6
Peranemidæ..... 30
Peridinidæ..... 31
Peridinium..... 31
Peritricha..... 53
Petalomonas..... 46
Phacus..... 39
Phyllomitus..... 29
Phytoflagellida..... 28
Plagiotomidæ..... 55
Pleuronema..... 55
Pleuronemidæ..... 55
Pleurotricha..... 99
Podophrya..... 115
Podophryidæ..... 58
Polymastigida..... 28
Polymastigidæ..... 29
Prorodon..... 61
Pseudodifflugia..... 7
Pyxidium..... 58

Quadrula..... 6

R

Radiolaria..... 5
Raphidiophrys..... 25
Reticulariida..... 5
Rhabdostyla..... 58
Rhizomastigidæ..... 28
Rhizopoda..... 5

S

Sarcodina..... 5
Scyphidia..... 105
Solenophrya..... 58
Sphærastrum..... 7
Sphærophrya..... 114
Spirostomum..... 91
Stentor..... 93
Stentoridæ..... 56
Stichotricha..... 97
Strombidium..... 56
Stylonychia..... 101
Suctoria..... 53

T

Trachelinidæ..... 54
Trachelius..... 71
Trachelomonas..... 41
Trachelophyllum..... 63
Trepomonas..... 36
Trichoda..... 74
Trichophrya..... 118
Trinema..... 22

U

Unidentified sp..... 93
Urocentridæ..... 55
Urocentrum..... 81
Uroleptus..... 98
Uronema..... 78
Urosoma..... 57
Urostyla..... 96
Urotricha..... 60

V

Vaginicola..... 113
Vampyrella..... 24
Vorticella..... 106
Vorticellidæ..... 57

Z

Zoöthamnium..... 57
Zygoselmis..... 30

PLATE I.

Fig. 1. *Amœba proteus* x 600, - - - - - 8
Fig. 2. *Amœba villosa* x 620, - - - - - 10
Fig. 3. *Amœba radiosa* x 620, - - - - - 10
Fig. 4. *Amœba verrucosa* x 500, - - - - - 11
Fig. 5. *Dinamœba mirabilis* x 600, - - - - 12

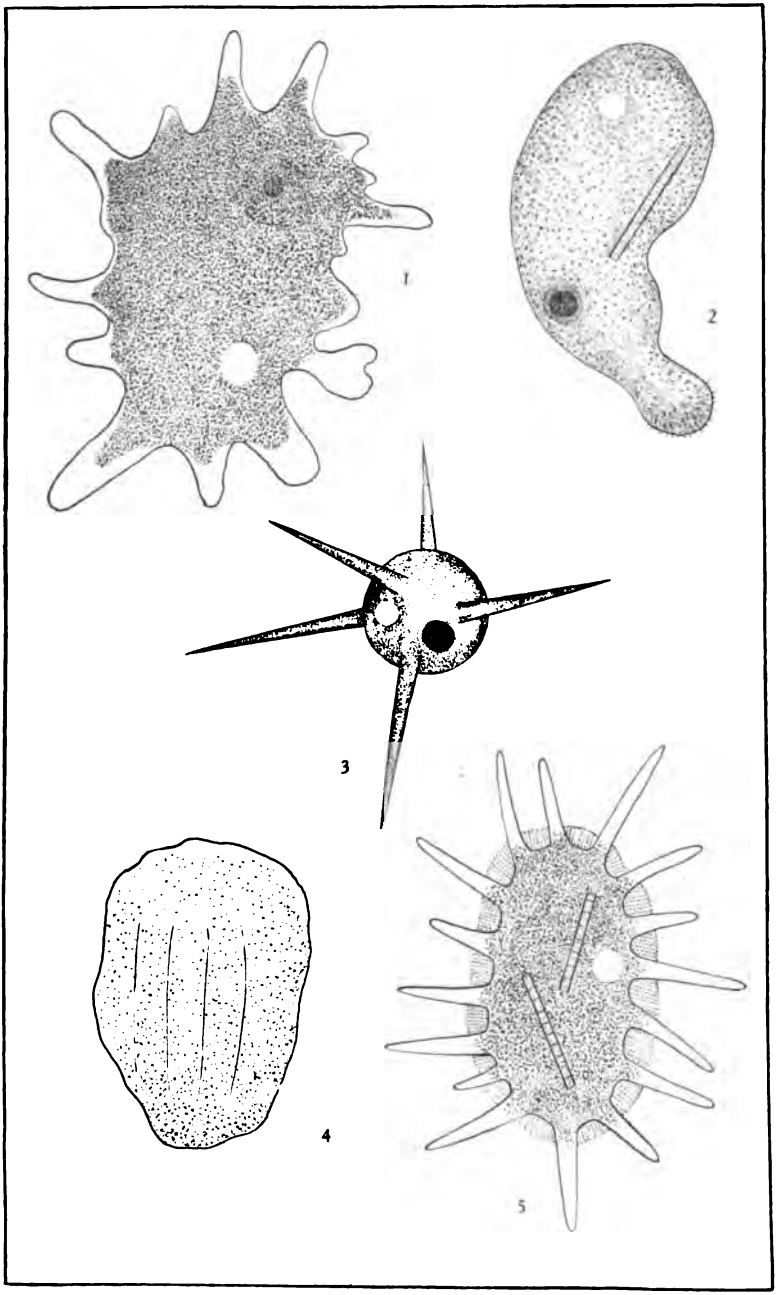

1
2
3
4
5

PLATE II.

		PAGE
Fig. 6.	*Difflugia globulosa*, lateral view, x 310, - -	13
Fig. 7.	*Difflugia globulosa*, ventral view, x 465, -	13
Fig. 8.	*Difflugia pyriformis*, conjugation, x 310, - -	12
Fig. 9.	*Difflugia pyriformis*, x 310, - - -	12
Fig. 10.	*Difflugia lobostoma*, lateral view, x 310, - -	15
Fig. 11.	*Difflugia lobostoma*, ventral view, x 210, -	15
Fig. 12.	*Difflugia pyriformis*, x 310, - - - -	12
Fig. 13.	*Difflugia acuminata*, x 310, - - - -	14
Fig. 14.	*Difflugia cratera*, x 465, - - - - .	13
Fig. 15.	*Difflugia cratera*, x 465, - - - -	13

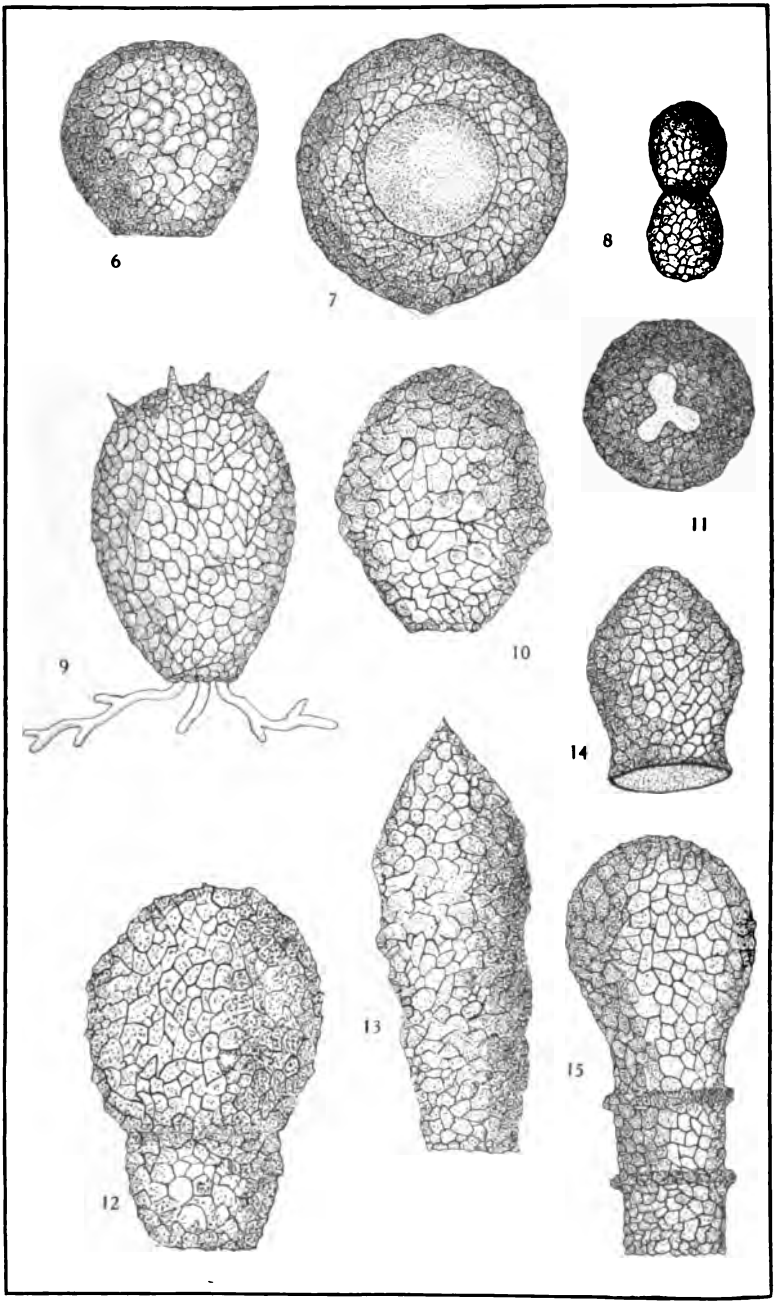

6
7
8
9
10
11
12
13
14
15

PLATE III.

		PAGE
Fig. 16.	*Difflugia corona*, x 310, - - - - -	16
Fig. 17.	*Difflugia constricta*, x 400, - - - -	14
Fig. 18.	*Difflugia spiralis*, x 310, - - - - -	16
Fig. 19.	*Difflugia urceolata*, x 310, - - - -	15
Fig. 20.	*Arcella vulgaris*, x 560, - - - - -	17
Fig. 21.	*Arcella vulgaris*, x 560, - - - -	17
Fig. 22.	*Arcella vulgaris*, conjugation, x 600, - - -	17

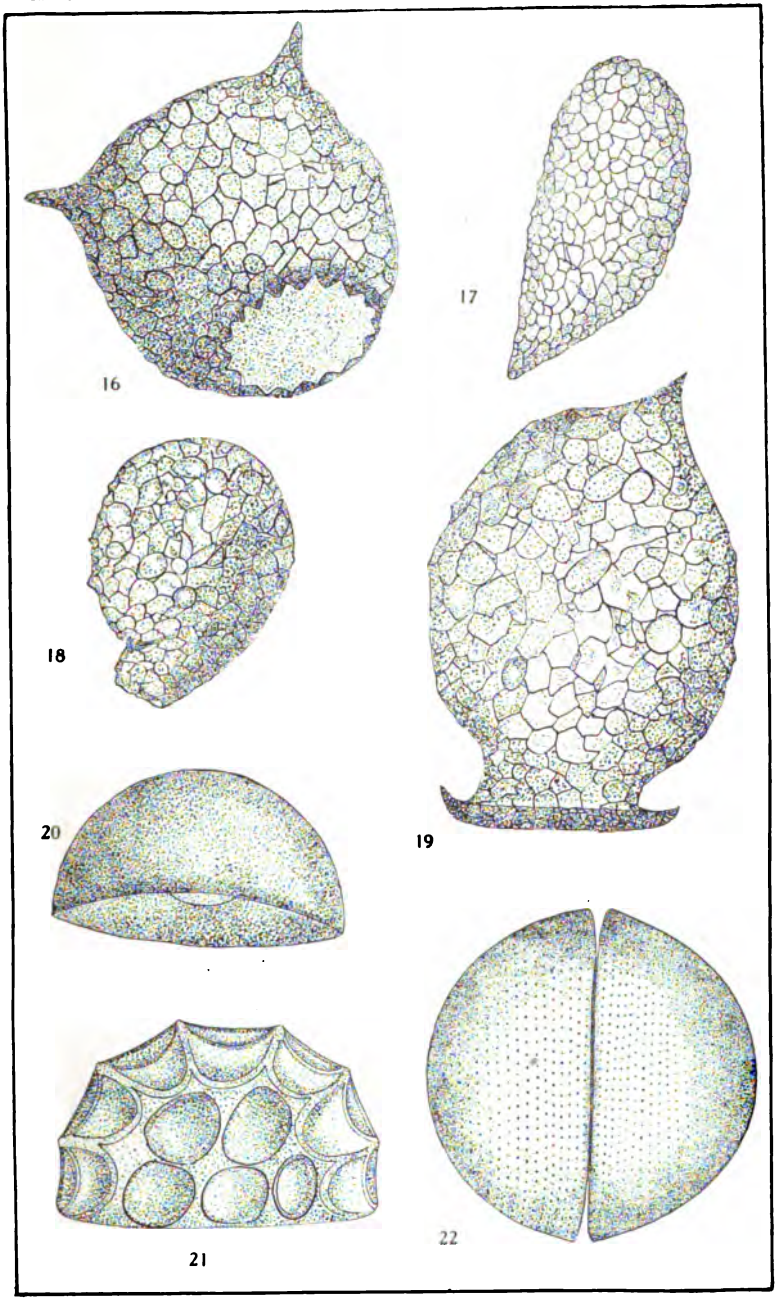

16
17
18
19
20
21
22

PLATE IV.

		PAGE
Fig. 23.	*Arcella vulgaris*, reproduction, x 620, - -	17
Fig. 24.	*Arcella vulgaris*, reproduction, x 560, - -	17
Fig. 25.	*Arcella discoides*, dorsal view, x 225, - - -	18
Fig. 26.	*Arcella discoides*, lateral view, x 225, - -	18
Fig. 27.	*Centropyxis aculeata*, ventral view, x 310, - .	18
Fig. 28.	*Centropyxis aculeata*, lateral view, x 500, -	18

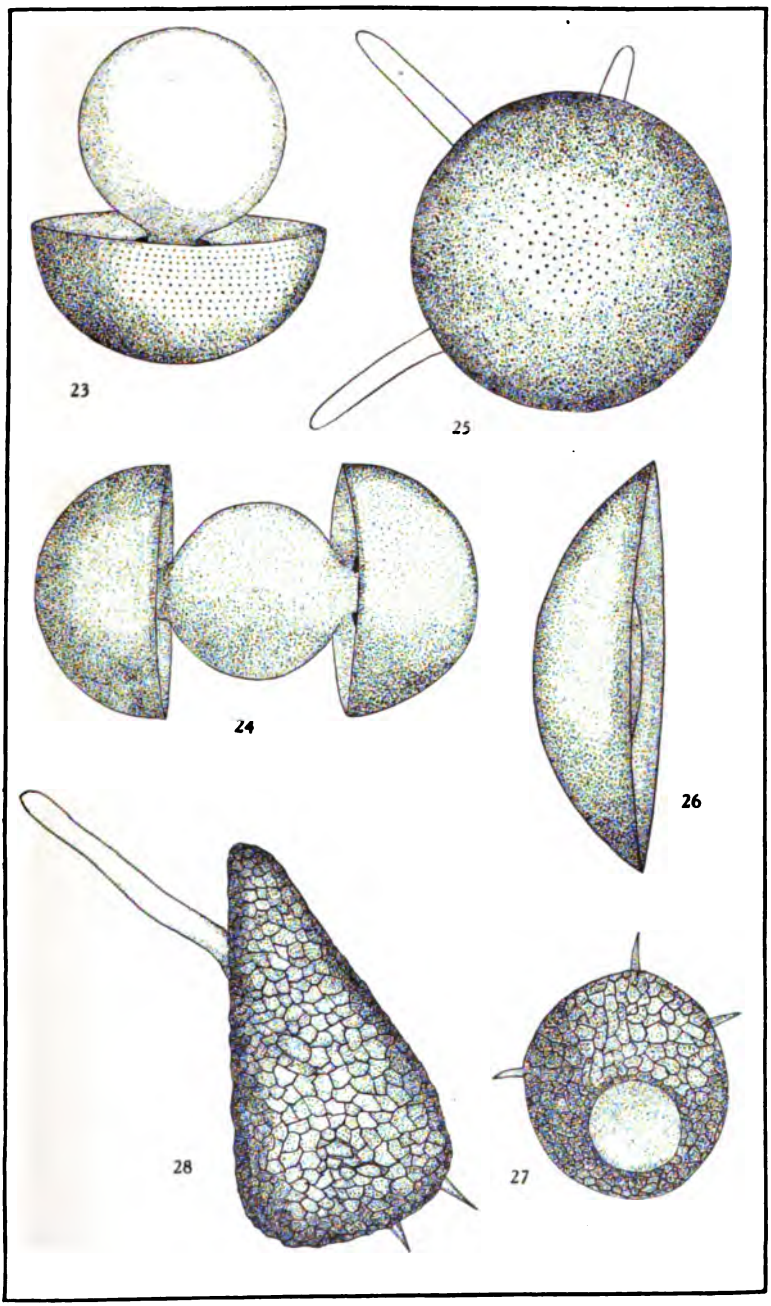

23
25
24
26
28
27

PLATE V.

		PAGE
Fig. 29.	*Cochliopodium bilimbosum*, x 850,	19
Fig. 30.	*Assulina seminulum*, x 930,	22
Fig. 31.	*Euglypha alveolata*, x 500,	21
Fig. 32.	*Pamphagus mutabilis*, x 850,	20
Fig. 33.	*Trinema enchelys*, ventral view, x 930,	22
Fig. 34.	*Trinema enchelys*, lateral view, x 930,	22
Fig. 35.	*Cyphoderia ampulla*, x 300,	21
Fig. 36.	*Actinophrys sol*, x 320,	23

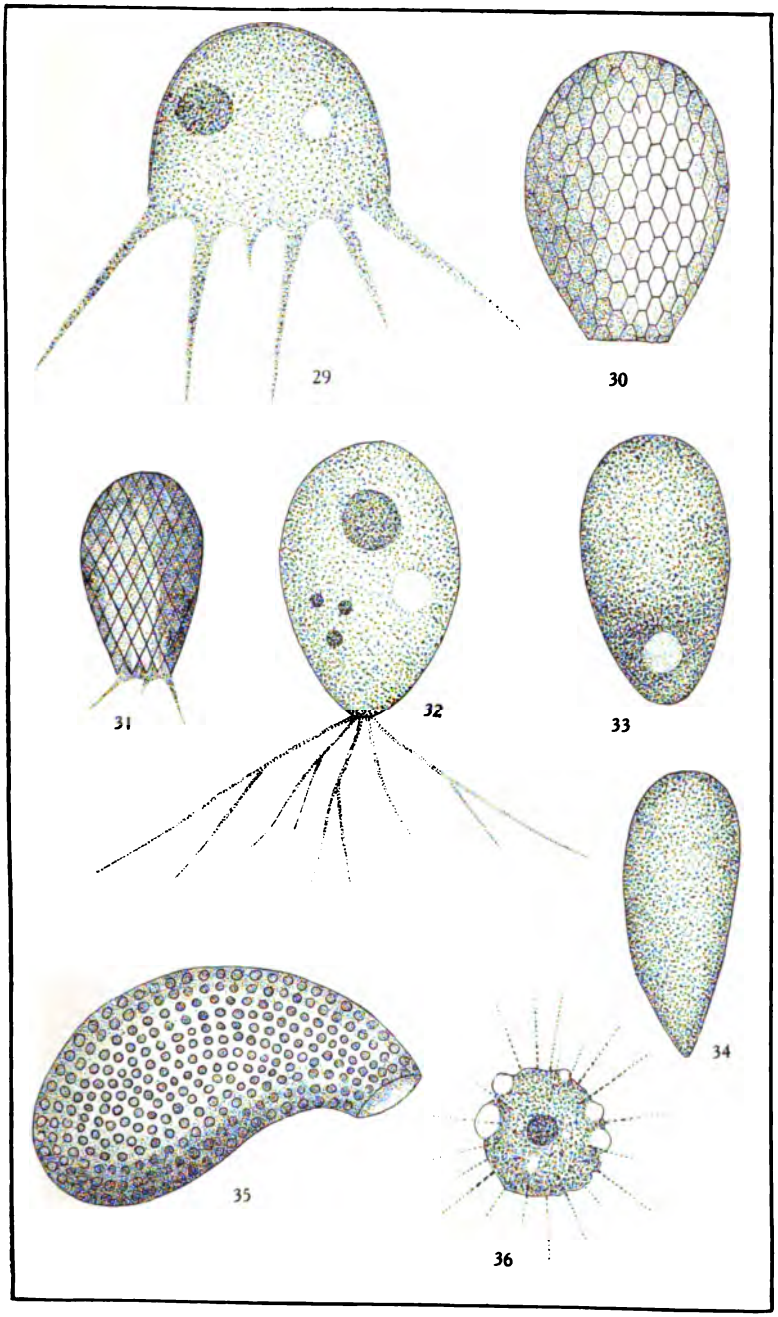

29
30
31
32
33
34
35
36

PLATE VI.

		PAGE
Fig. 37.	*Vampyrella lateritia*, normal phase, x 500, - -	24
Fig. 38.	*Vampyrella lateritia*, amœboid phase, x 500, -	24
Fig. 39.	*Raphidiophrys viridis*, x 300, - - - - -	26
Fig. 40.	*Clathrulina elegans*, an adult form, x 720, -	26
Fig. 41.	*Actinosphærium eichhornii*, one-half of an individual, x 200, - - - - - - -	24
Fig. 42.	*Clathrulina elegans*, an immature form, x 720, -	26

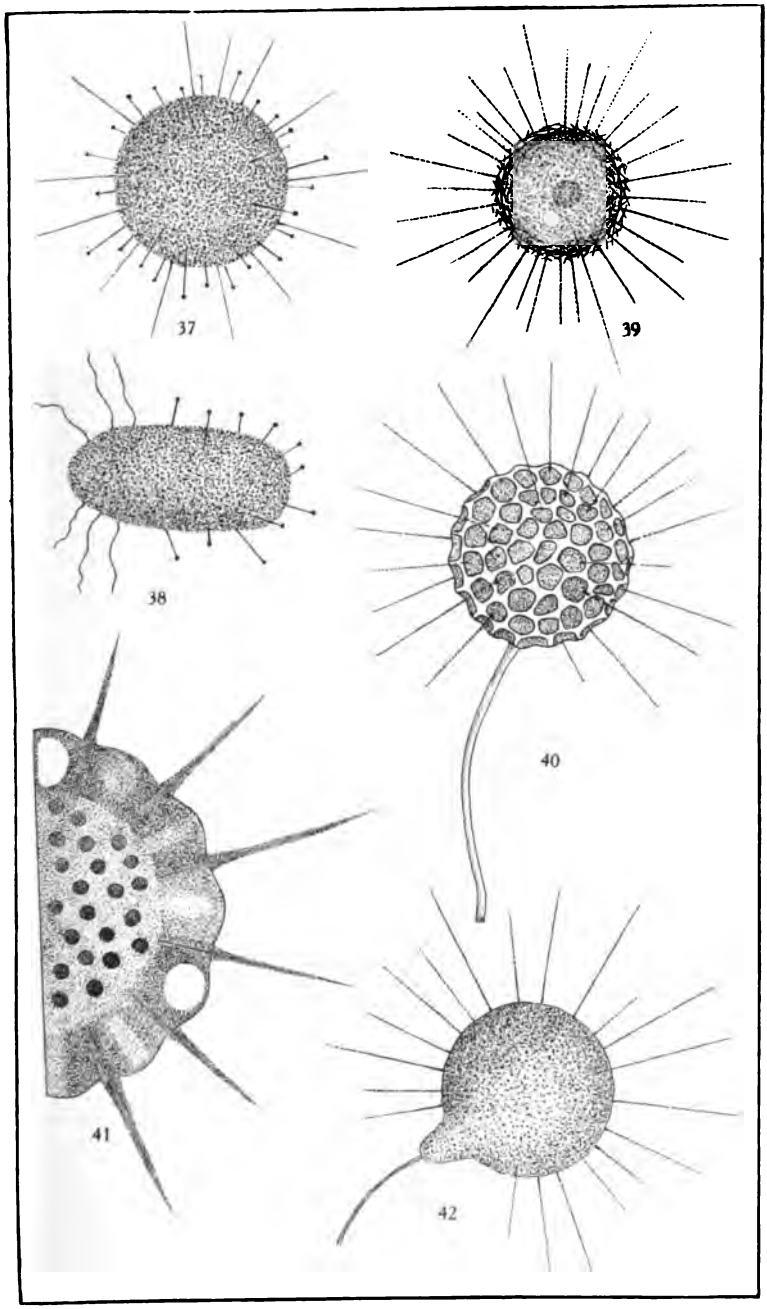

37
39
38
40
41
42

PLATE VII.

PAGE

Fig. 43. *Mastigamœba* sp., x 800, - - - - - - 32
Fig. 44. *Acinetactis mirabilis*, x 800, - - - - - 32
Fig. 45. *Monosiga steinii*, x 1500, - - - - - - 35
Fig. 46. *Trepomonas agilis*, x 800, - - - - - 36
Fig. 47. *Anthophysa vegetans*, a free-swimming cluster, x 500, 33
Fig. 48. *Anthophysa vegetans*, a branched colony, x 320, - 33
Fig. 49. *Codosiga botrytus*, x 1200, - - - - - 34
Fig. 50. *Heteromita* sp., x 1300, - - - - - - 35

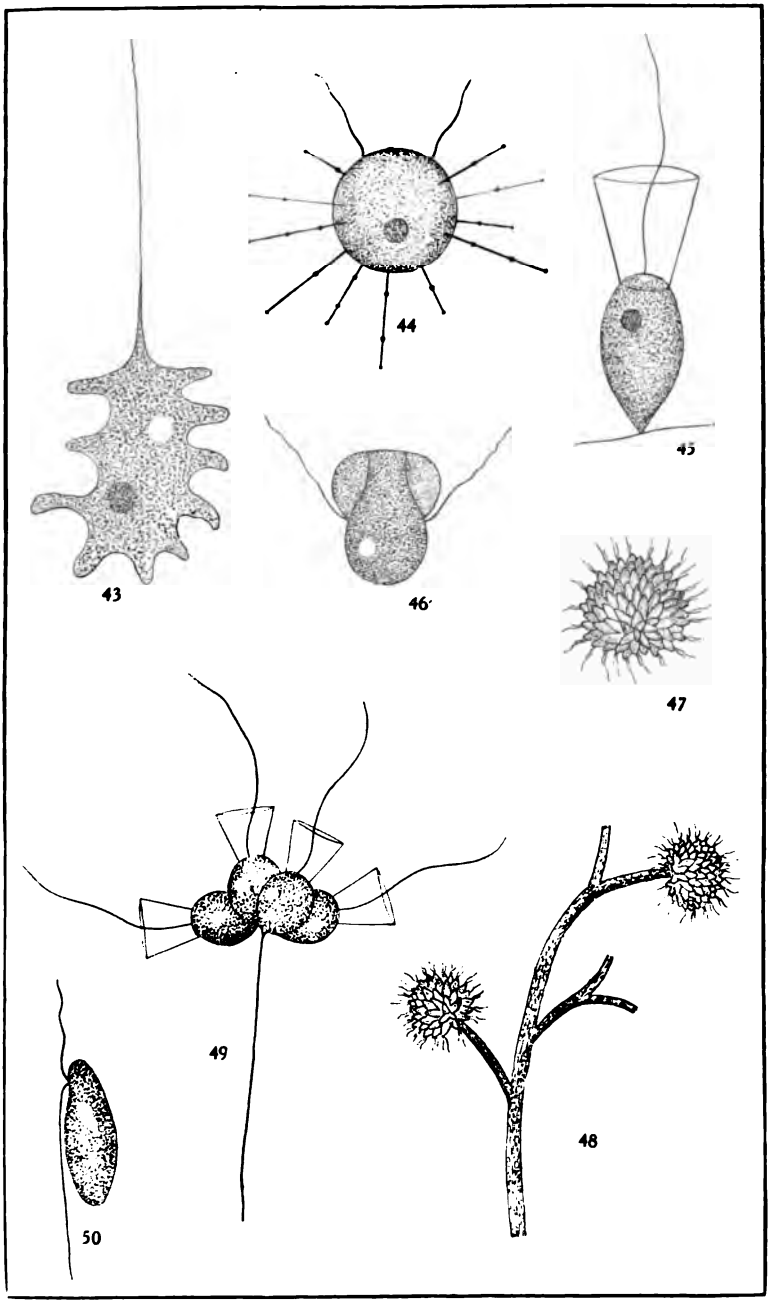

43
44
45
46
47
48
49
50

PLATE VIII.

		PAGE
Fig. 51.	*Euglena viridis*, x 620,	37
Fig. 52.	*Euglena spirogyra*, x 310,	37
Fig. 53.	*Euglena deses*, x 620,	38
Fig. 54.	*Euglena acus*, x 350,	38
Fig. 55.	*Phacus pleuronectes*, x 620,	39
Fig. 56.	*Phacus longicaudus*, x 310,	39
Fig. 57.	*Phacus pyrum*, x 580,	40
Fig. 58.	*Chloropeltis ovum*, x 900,	40
Fig. 59.	*Chloropeltis hispidula*, x 720,	40
Fig. 60.	*Chloropeltis* sp. (?), x 720,	41

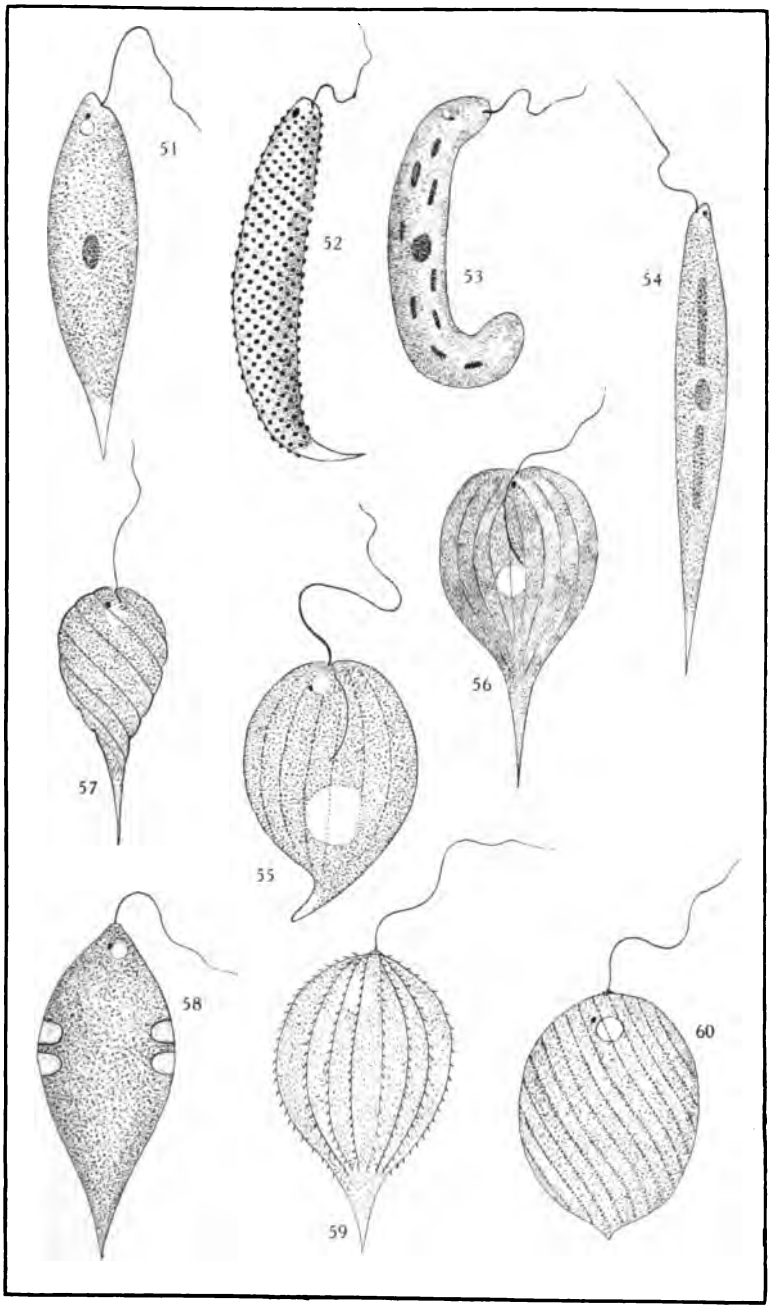

51
52
53
54
56
57
55
58
59
60

PLATE IX.

		PAGE
Fig. 61.	*Chlamydomonas* sp. (?), x 1300, - - - - -	51
Fig. 62.	*Chlamydomonas* sp., x 1300, - - - - -	52
Fig. 63.	*Chlamydomonas* sp., same as preceding sp., x 1300,	52
Fig. 64.	*Trachelomonas piscatoris*, x 650, - - -	41
Fig. 65.	*Trachelomonas cylindrica* (?), x 720, - - -	41
Fig. 66.	*Trachelomonas armata*, x 620, - - -	42
Fig. 67.	*Trachelomonas volvocina*, x 650, - - - -	43
Fig. 68.	*Trachelomonas volvocina*, x 650, - - -	43

PLATE IX.

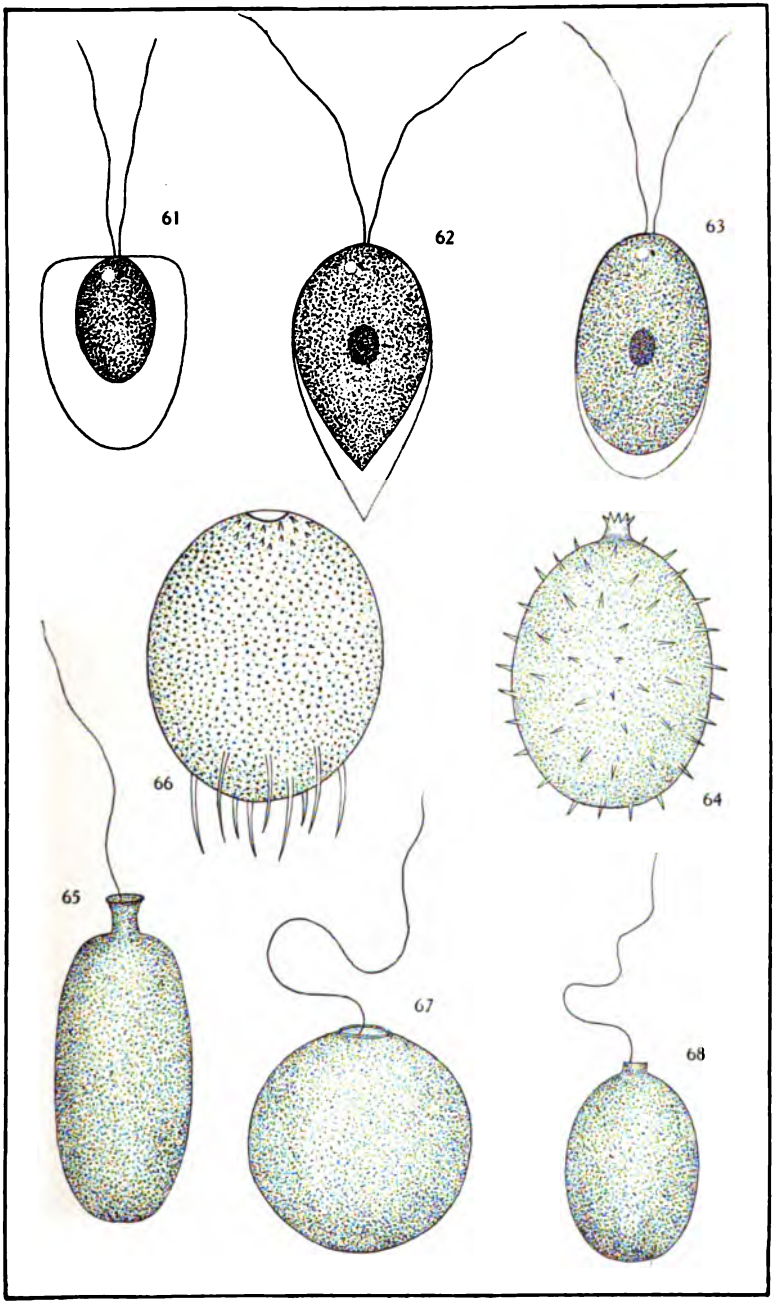


PLATE X.

		PAGE
Fig. 69.	*Trachelomonas horrida*, x 620, - - - -	42
Fig. 70.	*Trachelomonas hispida*, x 860, - - -	43
Fig. 71.	*Trachelomonas* sp., x 1240, - - - -	44
Fig. 72.	*Astasia trichophora*, extended, x 930, - -	45
Fig. 73.	*Astasia trichophora*, partially contracted, x 930, -	45
Fig. 74.	*Distigma proteus*, extended, x 580, - -	45
Fig. 75.	*Distigma proteus*, partially contracted, x 580, -	45
Fig. 76.	*Heteronema acus*, x 1000, - - - -	46

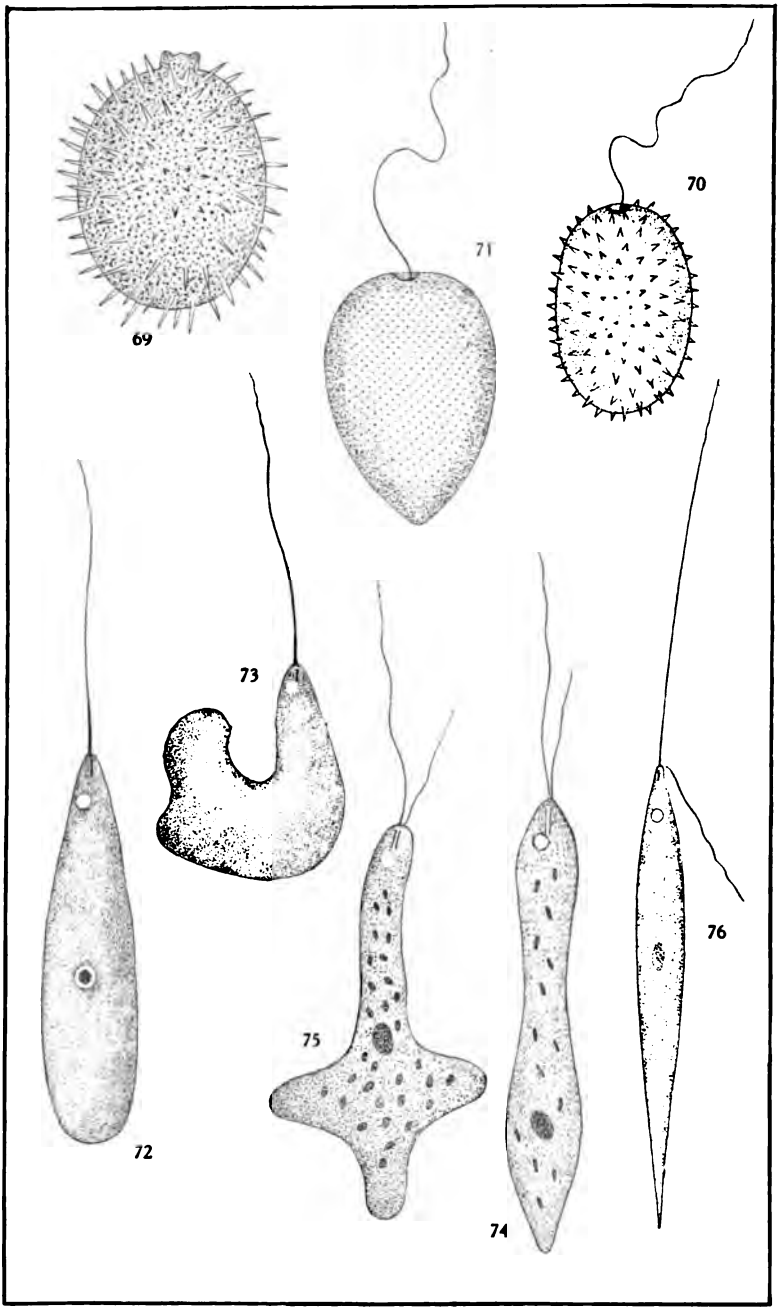

69
71
70
73
72
75
74
76

PLATE XI.

		PAGE
Fig. 77.	*Petalomonas mediocanellata*, x 1200, - - -	46
Fig. 78.	*Anisonema acinus*, x 1500, - - - -	47
Fig. 79.	*Anisonema ludibundum*, x 1500, - - . -	47
Fig. 80.	*Anisonema truucatum*, x 1500, - - -	48
Fig. 81.	*Entosiphon sulcatus*, x 1500, . - - -	48
Fig. 82.	*Notosolenus opocamptus*, x 2000, - - -	49
Fig. 83.	*Cryptoglena pigra*, x 2000, - - - - -	44
Fig. 84.	*Nephroselmis olivacea*, x 1000, - - -	49
Fig. 85.	*Mallomonas* sp., x 1200, - - - - -	49
Fig. 86.	*Chilomonas paramæcium*, x 1300, - - -	50
Fig. 87.	*Cryptomonas ovata*, x 1200, - - - -	51

PLATE XI.

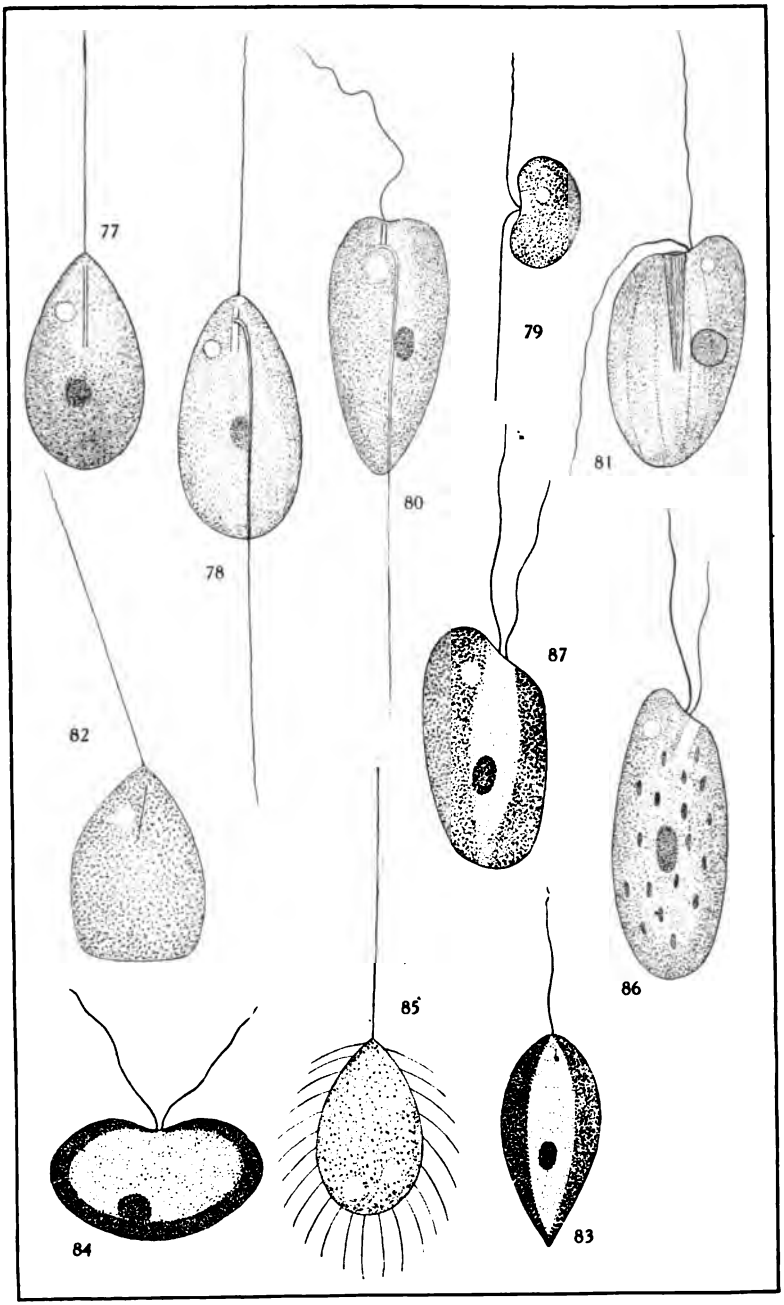


PLATE XII.

		PAGE
Fig. 88.	*Coleps hirtus*, x 620, - - - - - - -	59
Fig. 89.	*Holophrya kessleri*, x 310, - - - -	60
Fig. 90.	*Urotricha platystoma*, x 710, - - - -	60
Fig. 91.	*Urotricha* sp., x 710, - - - - - - -	60
Fig. 92.	*Enchelyodon farctus*, x 310 - - - -	61
Fig. 93.	*Prorodon teres*, x 250, - - - - - - -	62
Fig. 94.	*Prorodon edentatus*, x 300, - - - -	62
Fig. 95.	*Trachelophyllum tachyblastum*, x 310, - - -	63

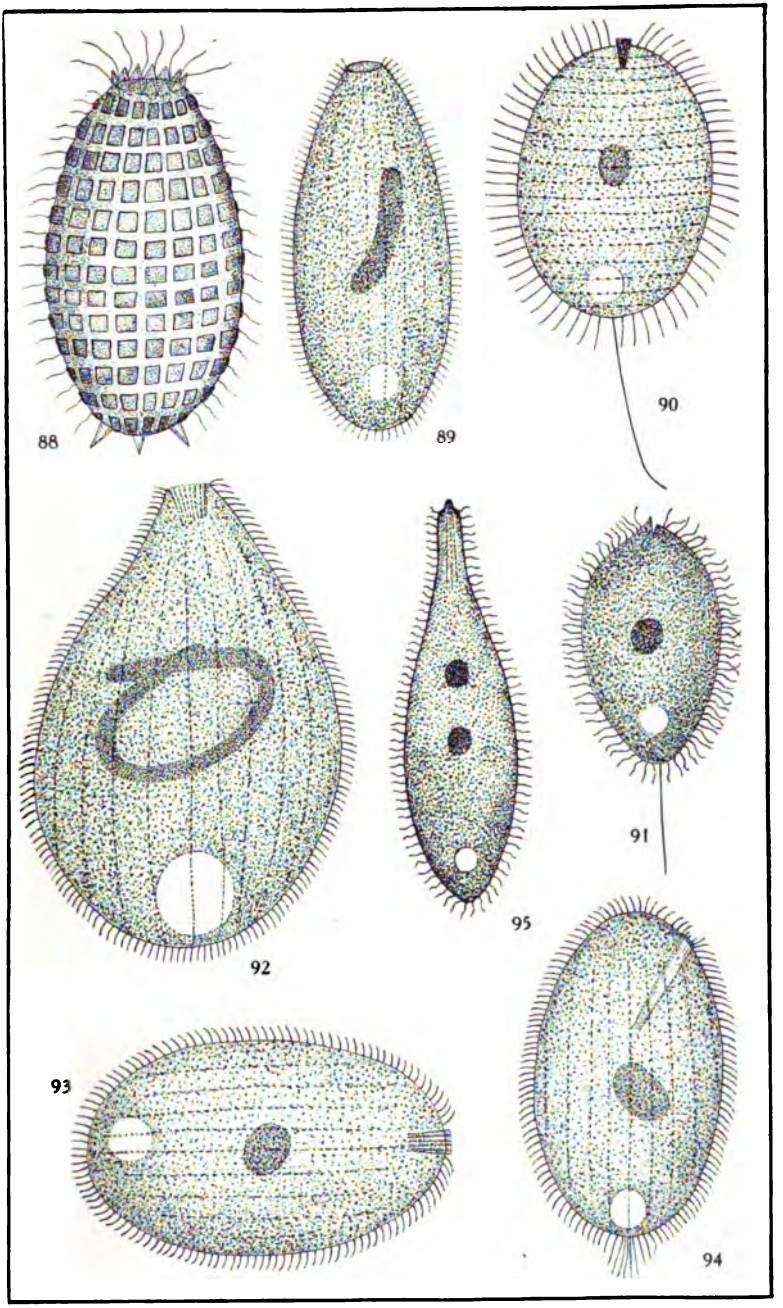

88
89
90
91
92
93
94
95

PLATE XIII.

		PAGE
Fig. 96.	*Didinium nasutum*, x 320, - - - - -	63
Fig. 97.	*Didinium nasutum*, swallowing *Paramæcium*, x 320, - - - - - - - - -	63
Fig. 98.	*Didinium nasutum*, diagram showing course of protoplasmic currents, x 320, - - - -	63
Fig. 99.	*Mesodinium* sp., x 1000, - - - - -	65
Fig. 100.	*Lacrymaria cohnii* (?), x 500, - - - - -	65
Fig. 101.	*Lacrymaria truncata*, x 310, - - - -	66
Fig. 102.	*Amphileptus meleagris*, x 310, - - - - -	67
Fig. 103.	*Loxophyllum* sp., x 200, - - - - -	68
Fig. 104.	*Lacrymaria olor*, x 620, - - - - - -	66

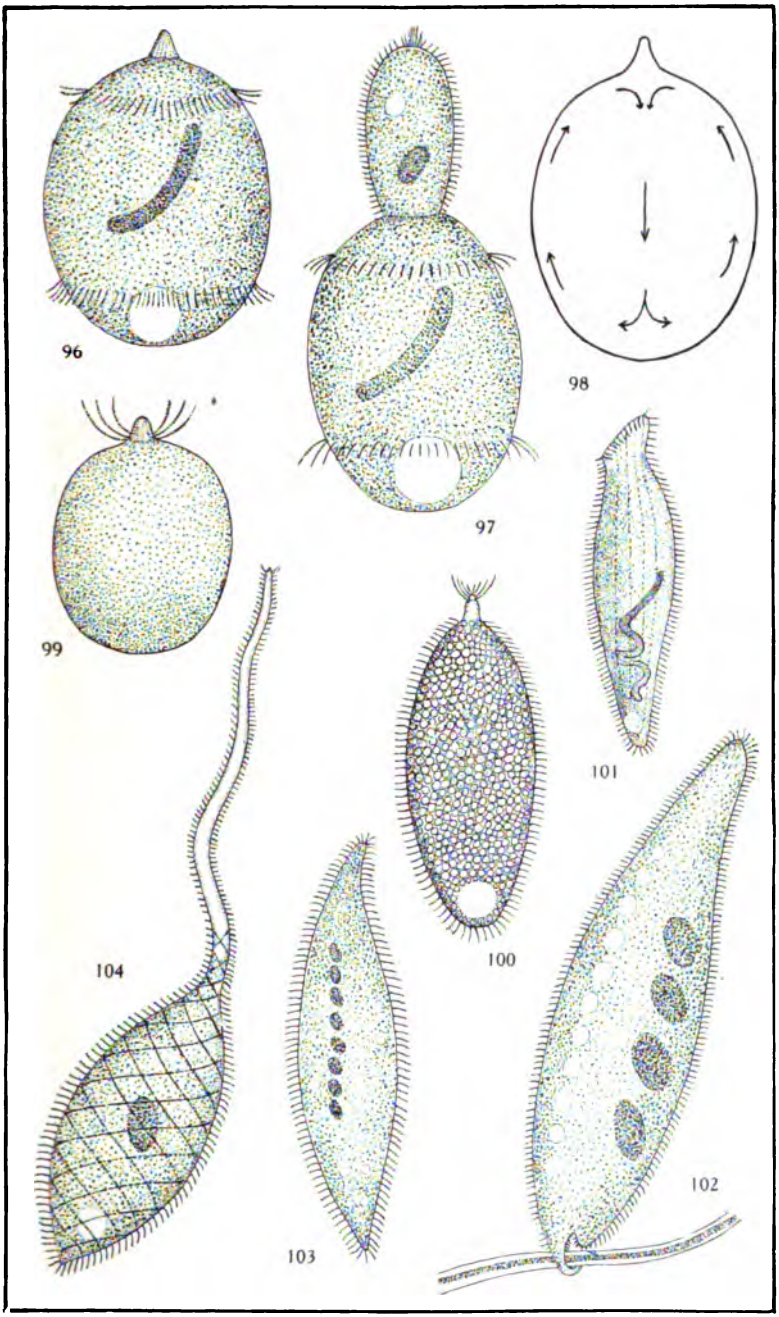

96
97
98
99
100
101
102
103
104

PLATE XIV.

		PAGE
Fig. 105.	*Amphileptus meleagris*, x 300, - - - -	67
Fig. 106.	*Dileptus gigas*, x 280, - - - - -	68
Fig. 107.	*Lionotus fasciola*, x 620, - - - - -	69
Fig. 108.	*Lionotus pleurosigma*, x 620, - - - -	70
Fig. 109.	*Loxodes rostrum*, x 200, - - - - -	70
Fig. 110.	*Trachelius ovum*, x 180, - - - -	71
Fig. 111.	*Nassula oronata*, x 240, - - - - -	71
Fig. 112.	*Nassula rubens*, x 400, - - - -	72

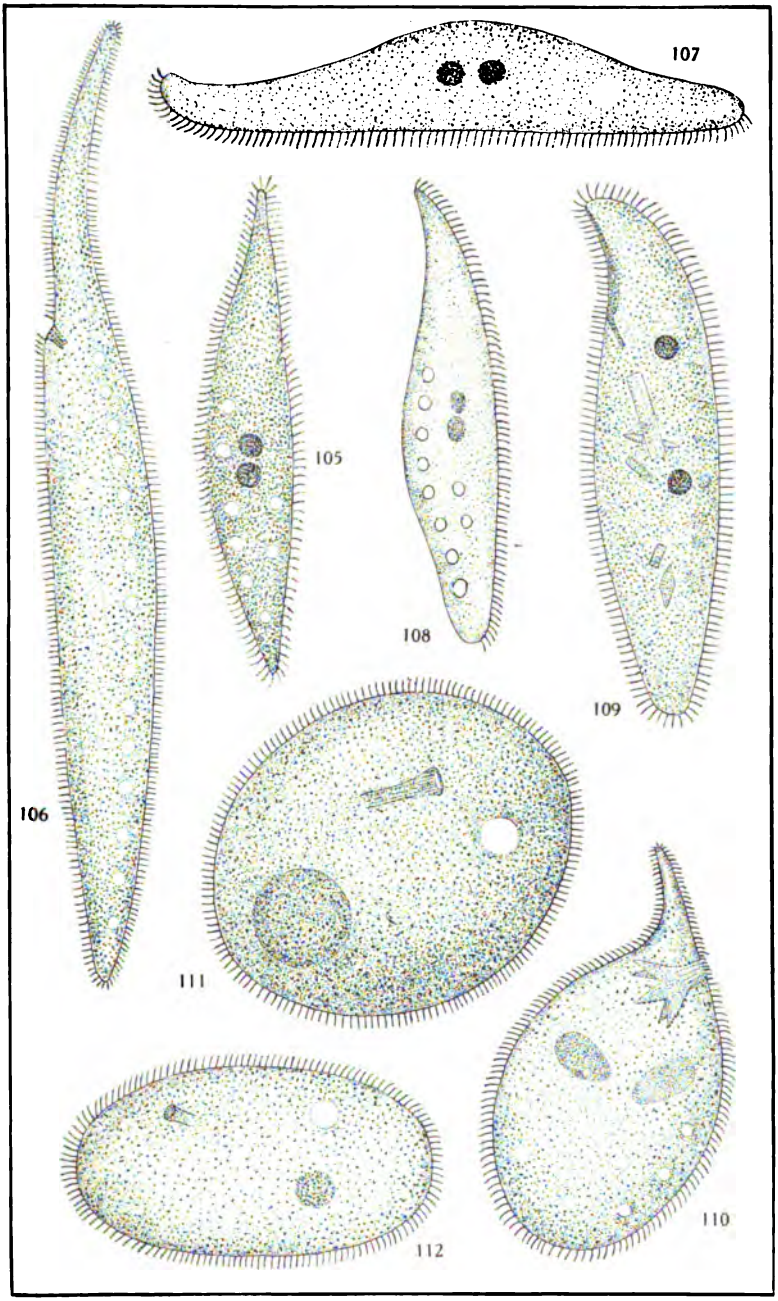

107
105
108
109
106
111
112
110

PLATE XV.

		PAGE
Fig. 113.	*Chilodon cucullulus*, x 350, - - - - -	72
Fig. 114.	*Chilodon caudatus*, x 620, - - - - -	73
Fig. 115.	*Chilodon caudatus*, lateral view of posterior extremity, x 800, - - - - - - -	73
Fig. 116.	*Chilodon fluviatilis*, x 620, - - - - -	73
Fig. 117.	*Ægyria* sp. (?), x 350, - - - - - -	74
Fig. 118.	*Trichoda pura*, x 1300, - - - - - -	74
Fig. 119.	*Leucophrys patula*, x 250, - - - - - -	75

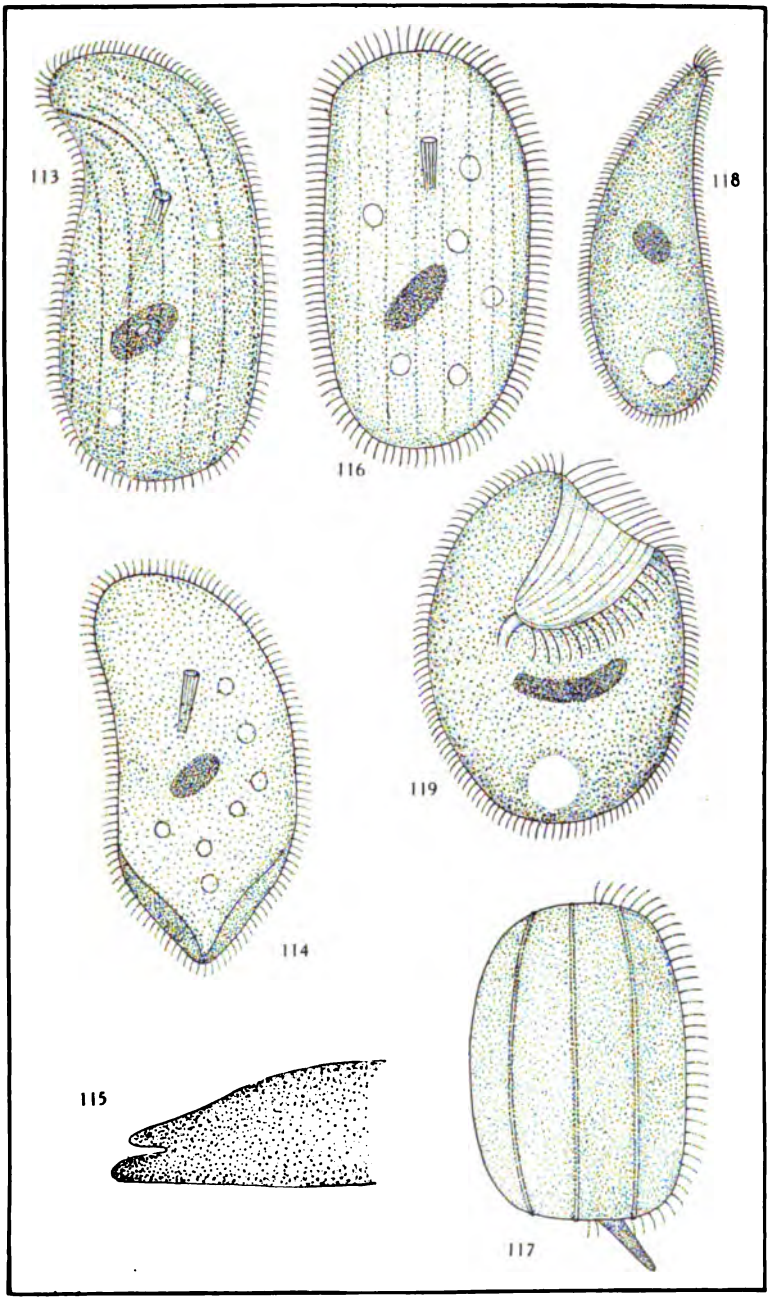

113
116
118
119
114
115
117

PLATE XVI.

		PAGE
Fig. 120.	*Glaucoma scintillans*, x 620,	75
Fig. 121.	*Glaucoma* sp. (?), x 840,	76
Fig. 122.	*Frontonia leucas*, x 300,	76
Fig. 123.	*Frontonia* sp. (?), x 165,	77
Fig. 124.	*Ophryoglena atra*, x 290,	77
Fig. 125.	*Loxocephalus granulosus*, x 500,	78
Fig. 126.	*Uronema marinum*, x 1000,	79
Fig. 127.	*Urocentrum tubro*, x 450,	81

PLATE XVI.

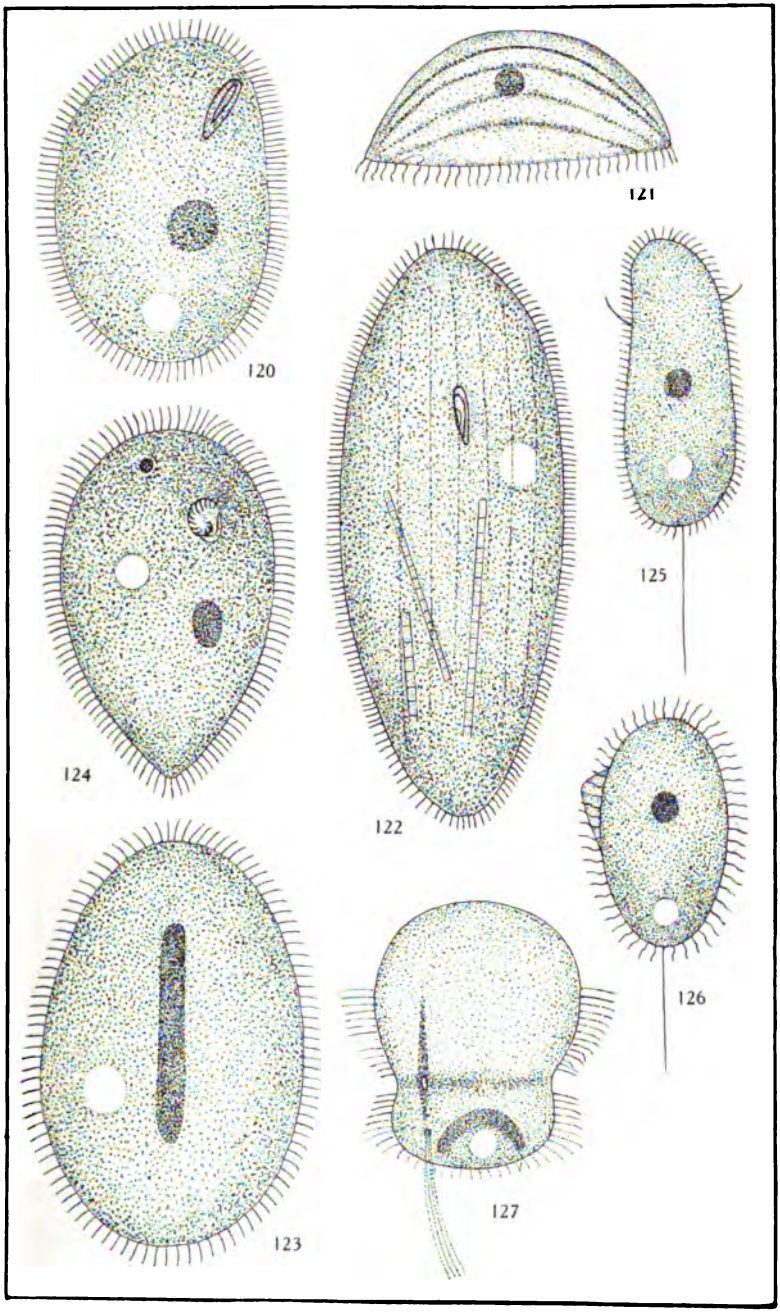


PLATE XVII.

		PAGE
Fig. 128.	*Colpidium striatum*, x 620, - - - - -	79
Fig. 129.	*Colpoda helia*, x 300, - - - - - -	80
Fig. 130.	*Colpoda saphrophila*, x 1200, - - - - -	80
Fig. 131.	*Colpoda flavicans*, x 600, - - - - -	80
Fig. 132.	*Colpoda campyla*, x 380, - - - - - -	80
Fig. 133.	*Colpoda* sp., x 900, - - - - - -	81
Fig. 134.	*Microthorax sulcatus*, x 930, - - - - -	82
Fig. 135.	*Cinetochilum margaritaceum*, x 1200, - - -	82

PLATE XVII.

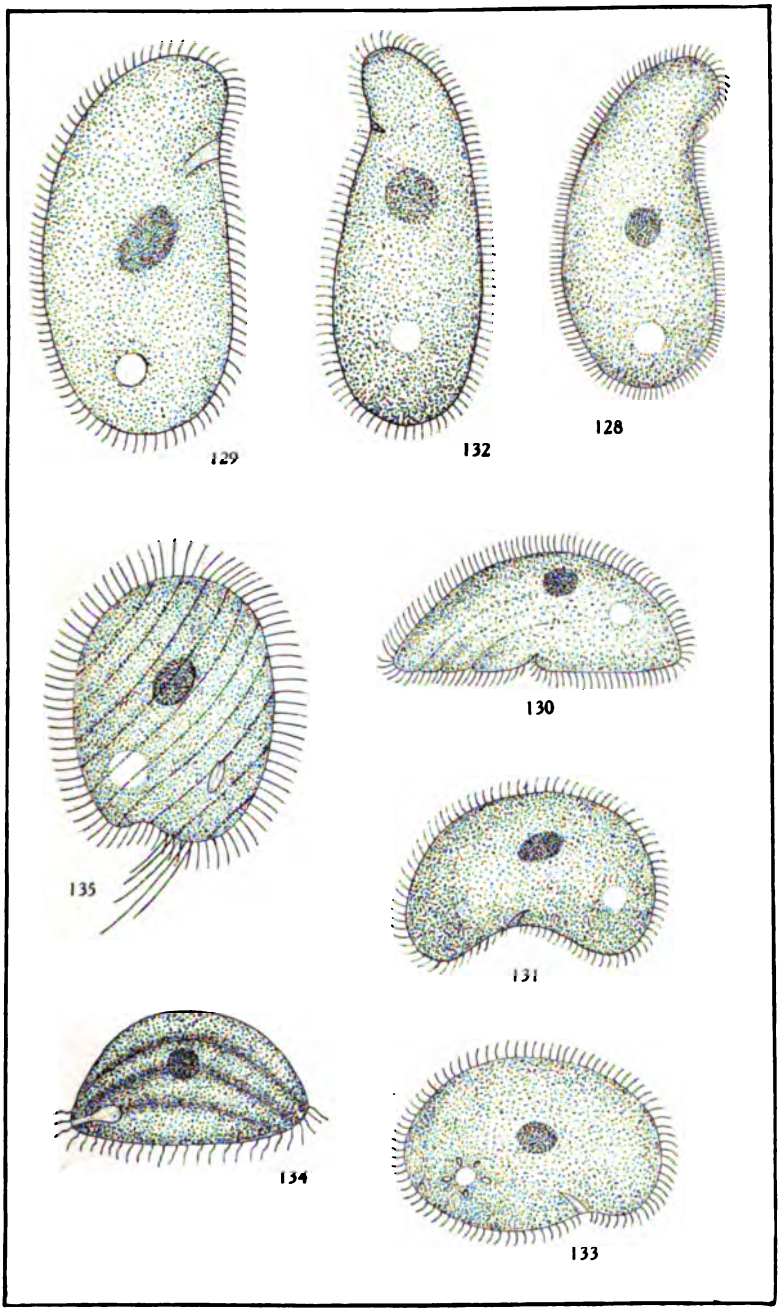


PLATE XXVIII.

Fig. 130. *Paramecium caudatum*, × 250, - - - - - 83

Fig. 131. *Paramecium caudatum*, in conjugation, × 250, 83

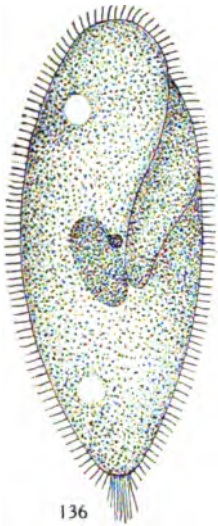
Fig. 132. *Paramecium caudatum*, model after conjugation.
× 250, - - - - - 83

Fig. 130. *Paramecium caudatum*, × 300 - - - - 80

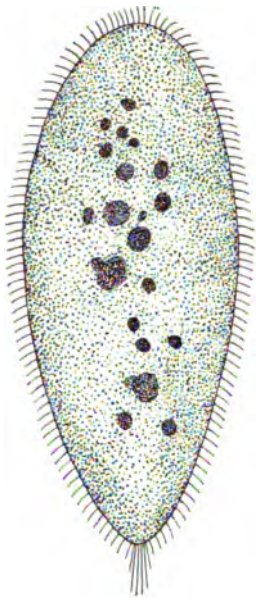
Fig. 140. *Paramecium bursaria*, × 420, - - - - - 85

PLATE XVIII.

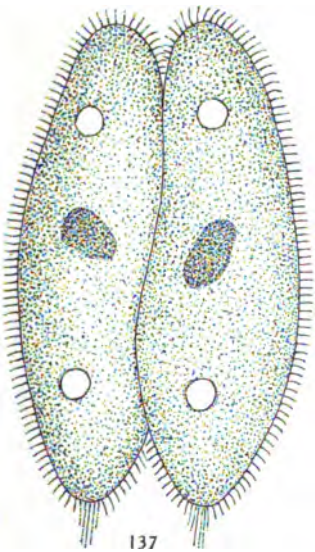
		PAGE
Fig. 136.	*Paramæcium caudatum*, x 250, - - - - -	83
Fig. 137.	*Paramæcium caudatum*, in conjugation, x 250,	83
Fig. 138.	*Paramæcium caudatum*, nuclei after conjugation, x 250, - - - - - - - - - -	83
Fig. 139.	*Paramæcium bursaria*, x 390, - - - -	86
Fig. 140.	*Paramæcium trichium*, x 420, - - - - -	86



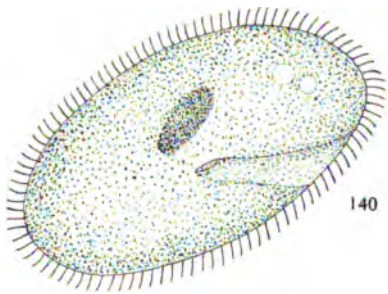
136



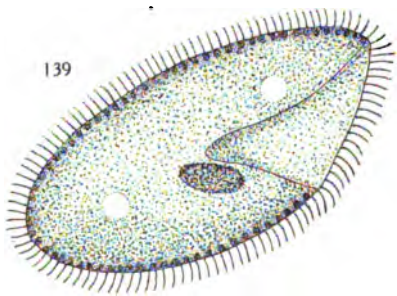
138



137



140



139

PLATE XIX.

		PAGE
Fig. 141.	*Lembadion bullinum*, x 620, - - - -	87
Fig. 142.	*Cyclidium glaucoma*, x 1200, - - - -	87
Fig. 143.	*Ctedoctema acanthocrypta*, x 1000, - - -	88
Fig. 144.	*Cyrtolophosis mucicola*, x 1000, - - -	89
Fig. 145.	*Blepharisma lateritia*, x 380, - - - -	90
Fig. 146.	*Metopus sigmoides*, x 310, - - - -	90

PLATE XIX.

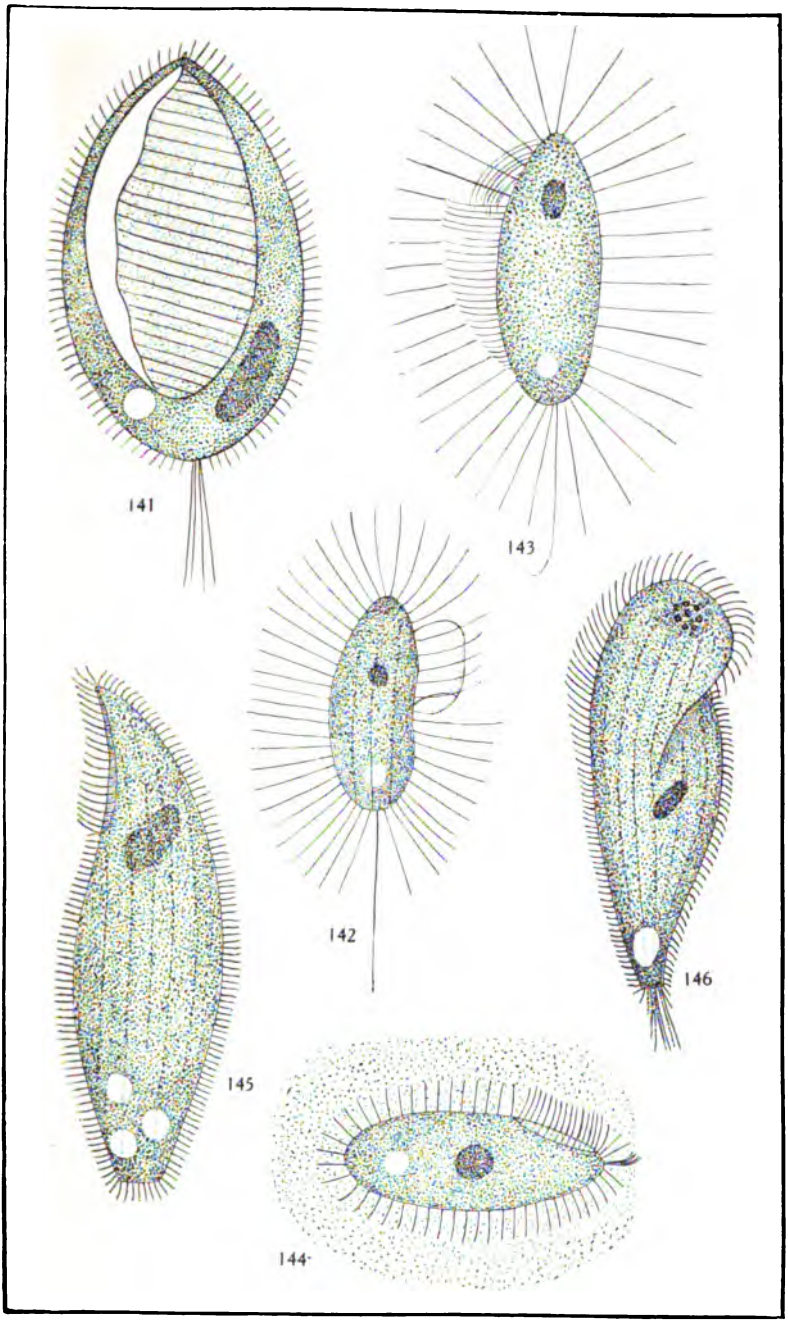


PLATE XX.

		PAGE
Fig. 147.	*Metopides acuminata*, x 620, - - - -	91
Fig. 148.	*Spirostomum ambiguum*, x 50, - - -	91
Fig. 149.	*Spirostomum ambiguum*, contracted, x 70, -	91
Fig. 150.	*Spirostomum teres*, x 180, - - - -	92
Fig. 151.	*Condylostoma* sp., x 500, - - - -	92
Fig. 152.	Unidentified sp., x 310, - - - - -	93

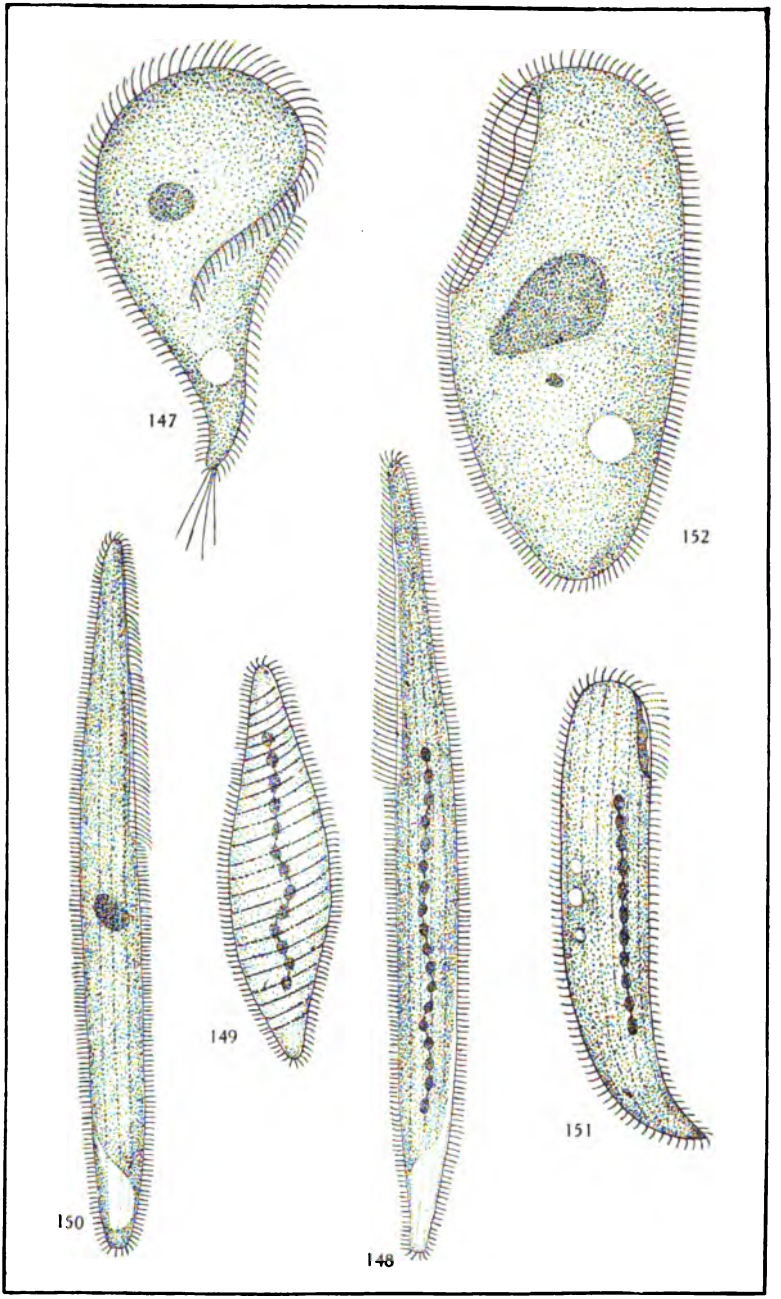

147
152
149
151
150
148

PLATE XXI.

PAGE

Fig. 153. *Stentor cæruleus*, x 100, - - - - - - 94

Fig. 154. *Stentor ræselii* (?), beginning of oblique fission, x 100, - - - - - - - - - - 94

Fig. 155. *Stentor ræselii* (?), further development of oblique fission, x 100, - - - - - - - - 94

Fig. 156. *Stentor ræselii* (?), oblique fission almost complete, x 80, - - - - - - - - - - 94

Fig. 157. *Gyrocoris oxyura*, x 500, - - - - - 96

Fig. 158. *Halteria grandinella*, x 800, - - - - - 96

PLATE XXI.

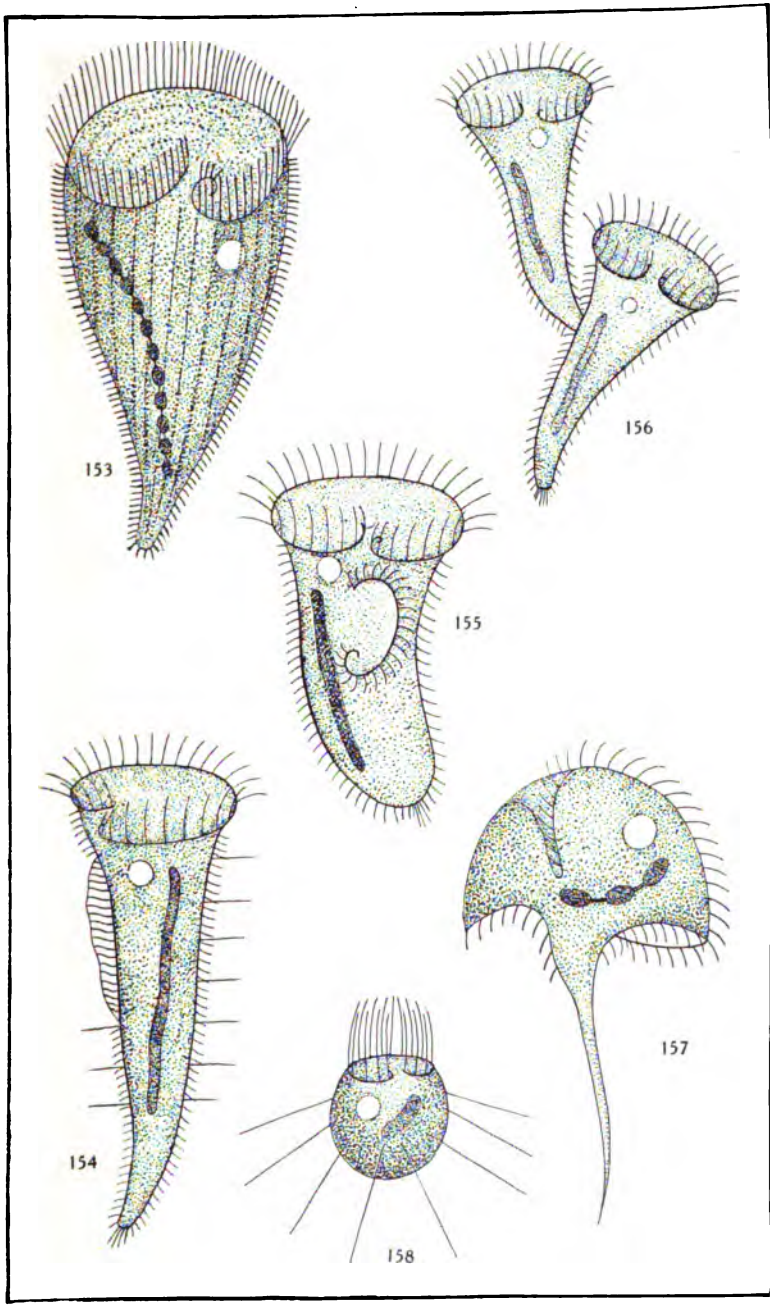


PLATE XXII.

		PAGE
Fig. 159.	*Urostyla grandis*, x 200, - - - - - -	97
Fig. 160.	*Pleurotricha lanceolata*, x 225 - - -	99
Fig. 161.	*Gastrostyla steinii*, x 250, - - - - - -	99
Fig. 162.	*Stylonychia pustulata*, x 460 - - - -	102
Fig. 163.	*Stylonychia notophora*, x 600, - - - - -	102

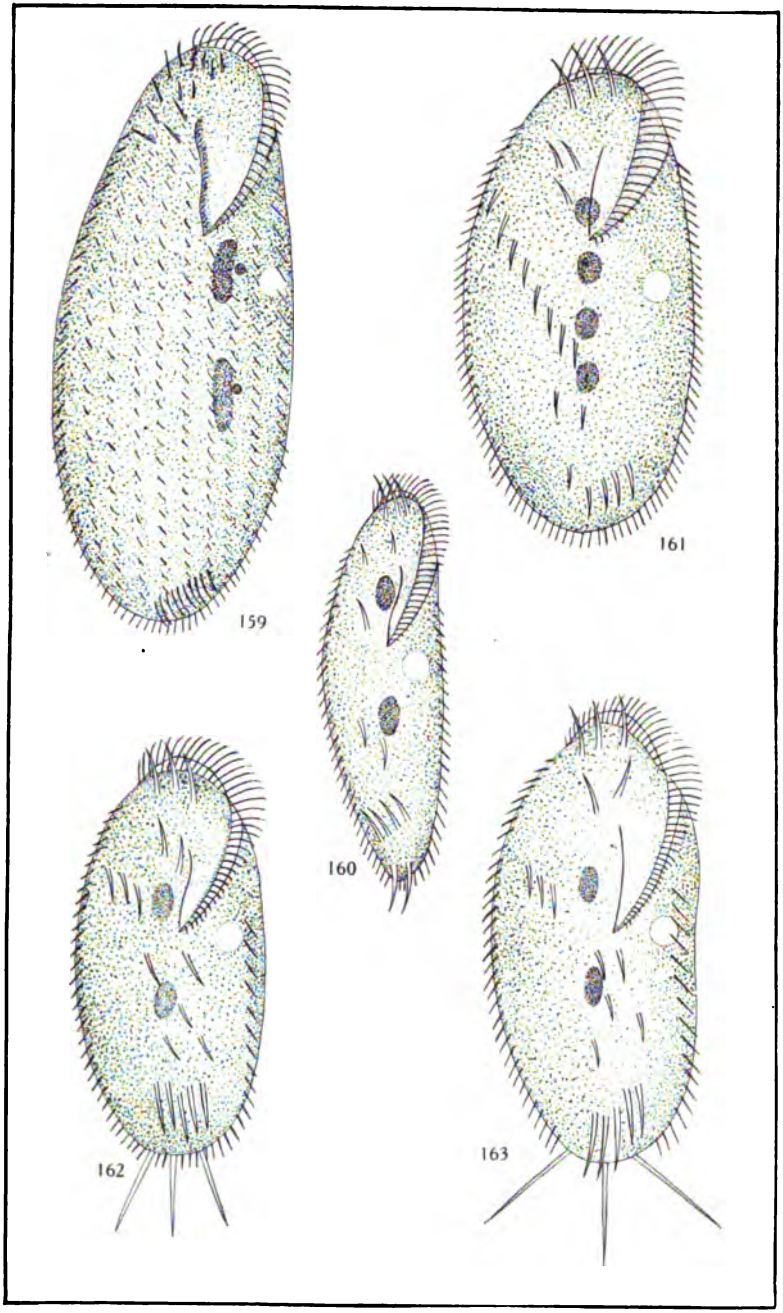

159
161
160
162
163

PLATE XXIII.

		PAGE
Fig. 164.	*Uroleptus rattulus*, x 120, - - - - -	98
Fig. 165.	*Uroleptus agilis*, x 200, - - - -	98
Fig. 166.	*Histrio steinii*, x 300, - - - - -	101
Fig. 167.	*Oxytricha pellionella*, x 440, - - - -	100
Fig. 168.	*Oxytricha platystoma*, x 400, - - - -	100
Fig. 169.	*Stylonychia mytilus*, x 300, - - - -	101
Fig. 170.	*Stylonychia* sp., x 310, - - - - -	102

PLATE XXIII.

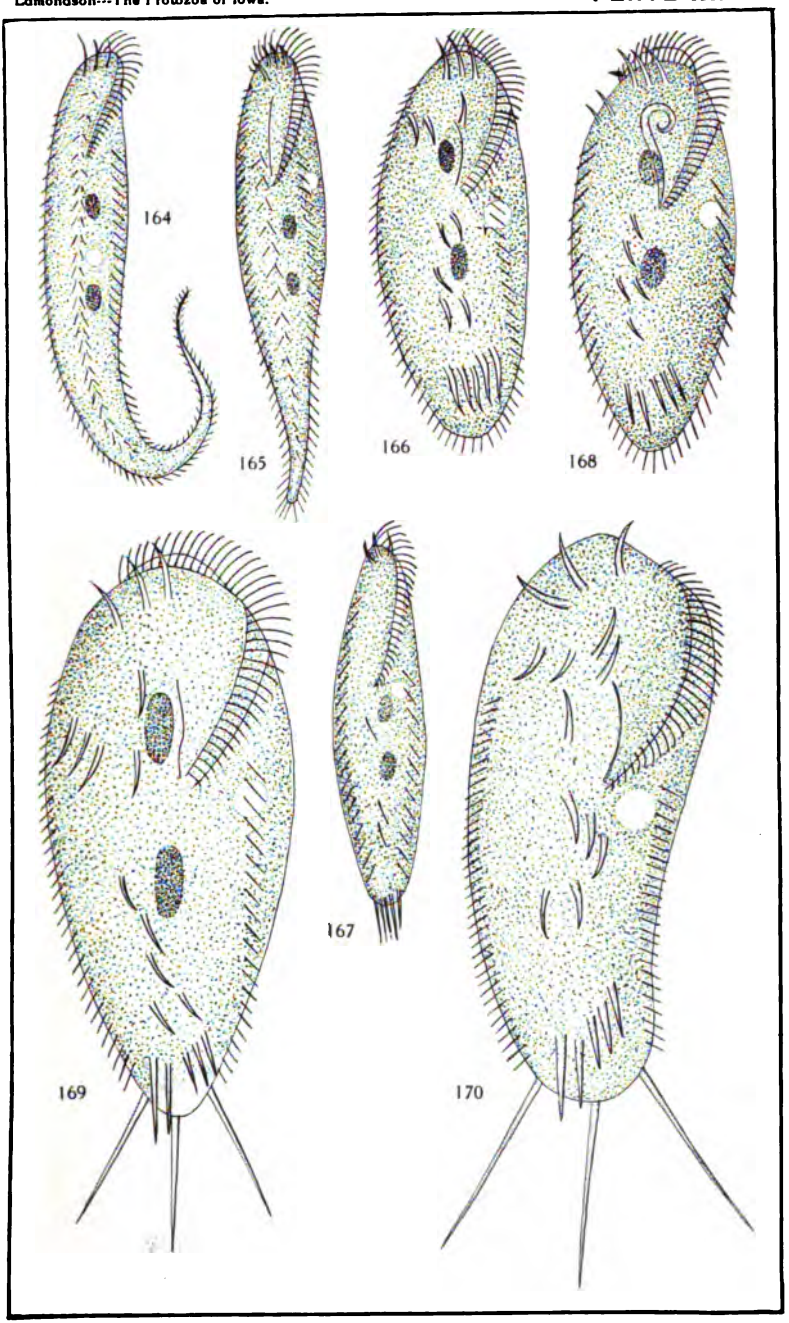


PLATE XXIV.

		PAGE
Fig. 171.	*Stichotricha aculeata*, x 600, - - - -	97
Fig. 172.	*Euplotes charon*, dorsal view, x 600, - -	103
Fig. 173.	*Euplotes patella*, ventral view, x 420, - -	103
Fig. 174.	*Euplotes carinata*, ventral view, x 650, - -	104
Fig. 175.	*Aspidisca costata*, dorsal view, x 1400, - -	104
Fig. 176.	*Aspidisca costata*, ventral view, x 1400, - -	104

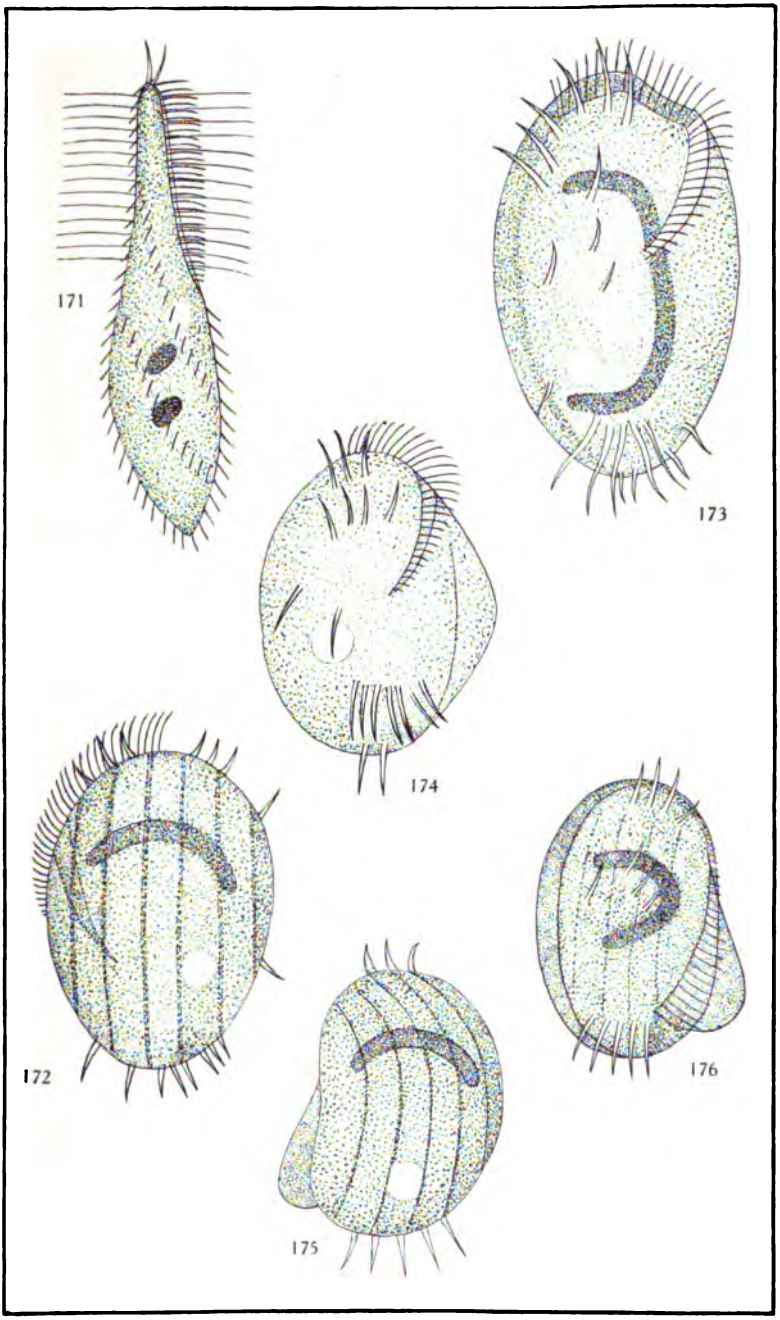

171
173
174
172
176
175

PLATE XXV.

PAGE

Fig. 177. Cerda glans, x 460, - - - - - - - 105
Fig. 178. Scyphidia inclinans, x 750, - - - - - 105
Fig. 179. Scyphidia inclinans, contracted, x 750, - - 105
Fig. 180. Scyphidia sp., x 960, - - - - - - 106
Fig. 181. Scyphidia sp., same as preceding, contracted, x 960 106
Fig. 182. Vorticella campanula, x 270, - - - - - 107
Fig. 183. Vorticella nutans, x 480, - - - - - 107
Fig. 184. Vorticella alba, x 540, - - - - - - 107
Fig. 185. Vorticella telescopa, x 560, - - - - - 108

PLATE XXV.

		PAGE
Fig. 177.	*Gerda glans*, x 460, - - - - - - -	105
Fig. 178.	*Scyphidia inclinans*, x 750, - - - - -	105
Fig. 179.	*Scyphidia inclinans*, contracted, x 750, - -	105
Fig. 180.	*Scyphidia* sp., x 960, - - - - - -	106
Fig. 181.	*Scyphidia* sp., same as preceding, contracted, x 960	106
Fig. 182.	*Vorticella campanula*, x 270, - - - - -	107
Fig. 183.	*Vorticella nutasn*, x 480, - - - - -	107
Fig. 184.	*Vorticella alba*, x 540, - - - - - -	107
Fig. 185.	*Vorticella telescopa*, x 560, - - - - -	108

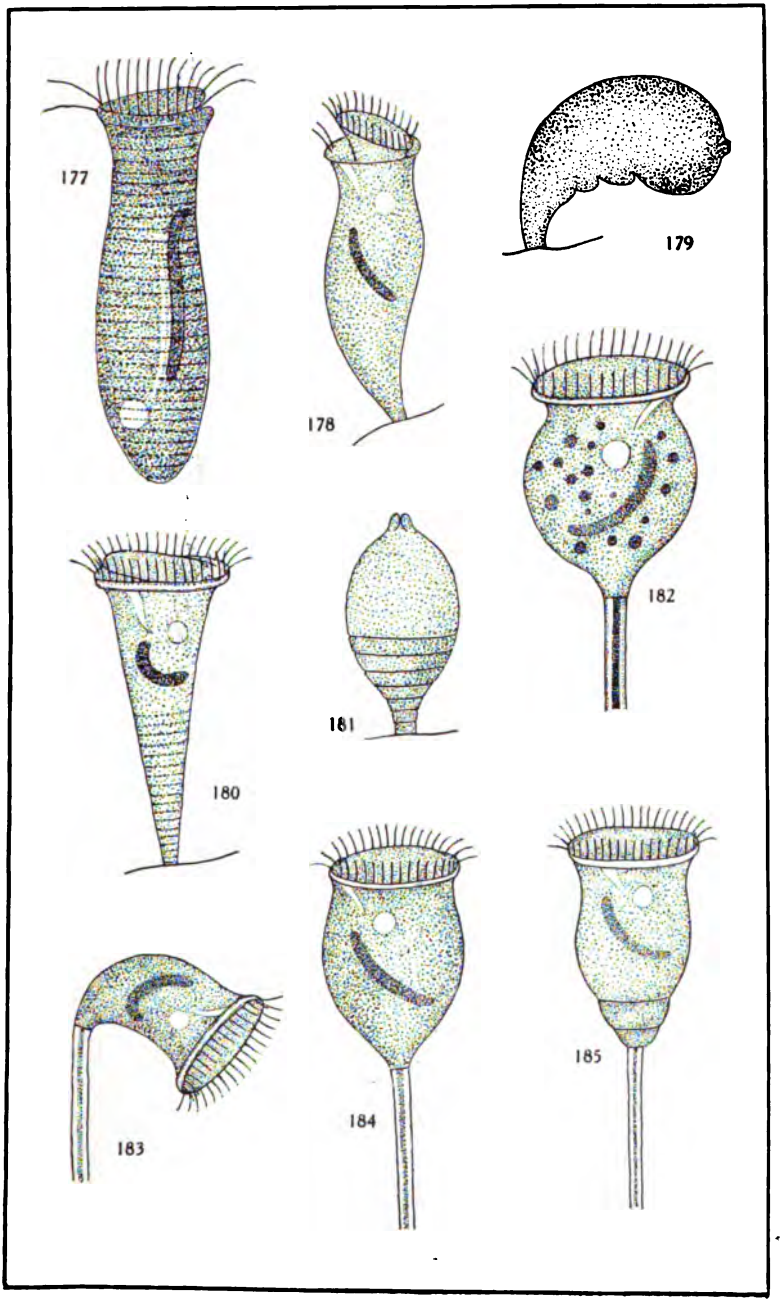

177
178
179
180
181
182
183
184
185

PLATE XXVI.

		PAGE
Fig. 186.	*Vorticella fluviatilis*, x 600, - - - -	109
Fig. 187.	*Vorticella citrina*, x 510, - - - -	108
Fig. 188.	*Vorticella quadrangularis* (?), x 250, - - -	108
Fig. 189.	*Vorticella elongata*, x 420, - - - -	109
Fig. 190.	*Vorticella convallaria*, x 300, - - - -	109
Fig. 191.	*Vorticella longifilum*, x 310, - - - -	107
Fig. 192.	*Vorticella* sp., x 540, - - - - -	108
Fig. 193.	*Vorticella* sp., x 810, - - - - -	109

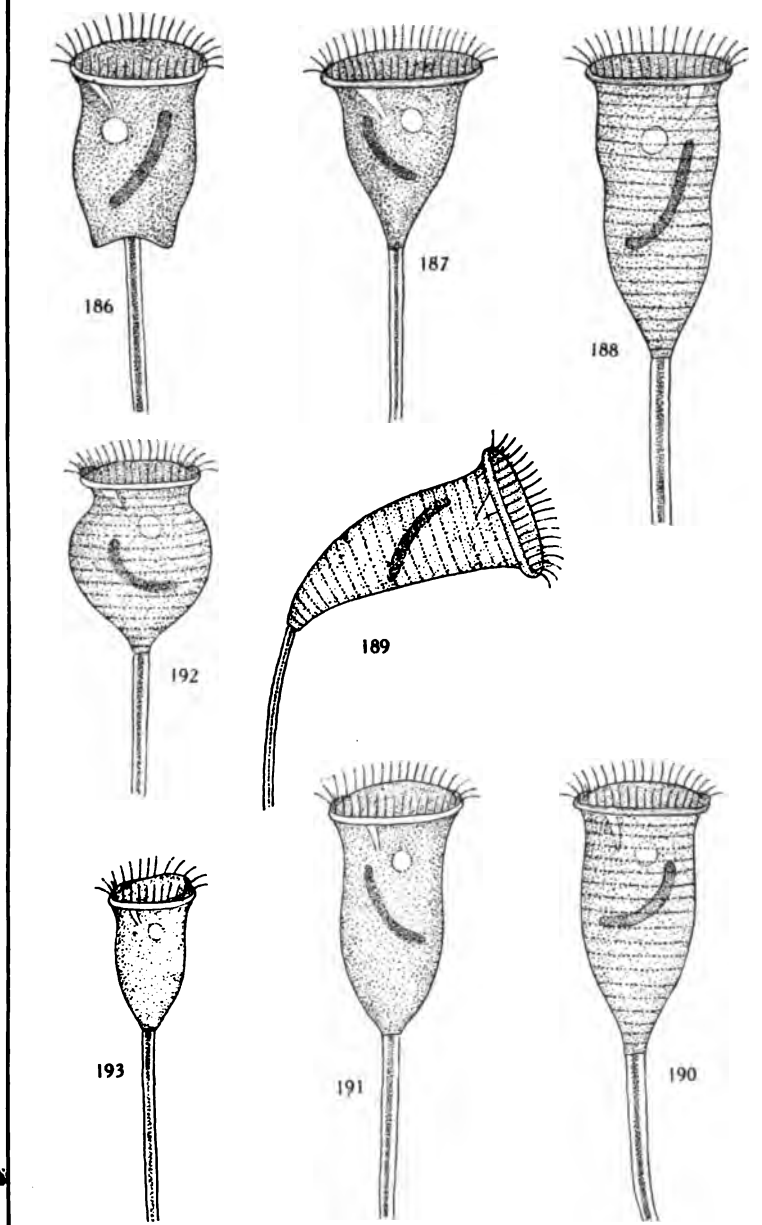

186
187
188
189
192
193
191
190

PLATE XXVII.

PAGE

Fig. 194. *Carchesium polypinum*, fragment of a colony, x 150, - - - - - - - - - - 110

Fig. 195. *Carchesium polypinum*, a single zoöid, x 310. 110

Fig. 196. *Carchesium polypinum*, nucleus, result of lack of nutrition, x 1200, - - - - - - - - - 100

Fig. 197. *Epistylis articulata*, a young colony, x 150, - 112

Fig. 198. *Epistylis articulata*, growth by division of zoöids. From a prepared mount, zoöids contracted, x 120, - - - - - - - - - 112

Fig. 199. *Epistylis articulata*, a single zoöid, contracted, x 300, - - - - - - - - 112

PLATE XXVII.

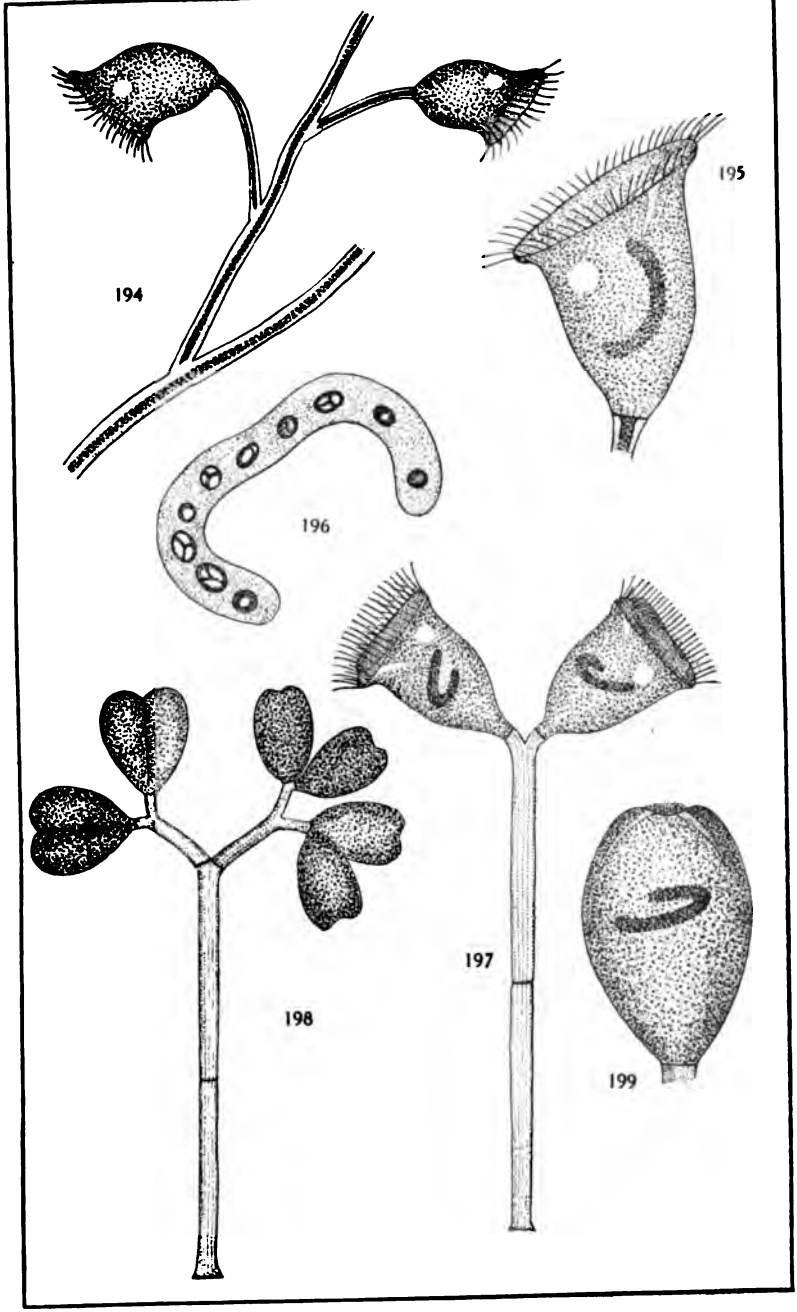


PLATE XXVIII.

		PAGE
Fig. 200.	*Epistylis plicatilis*, portion of a young colony, x 80,	112
Fig. 201.	*Epistylis plicatilis*, a contracted zoöid, x 150,	112
Fig. 202.	*Epistylis flavicans*, a young colony, x 150,	111
Fig. 203.	*Epistylis flavicans*, a zoöid showing ciliary convolutions, from a stained preparation, x 200,	111
Fig. 204.	*Vaginicola* sp., undergoing division, zoöids contracted, x 310,	113
Fig. 205.	*Cothurnia imberbis*, undergoing division, x 310,	113
Fig. 206.	*Cothurnia curva*, x 310,	114

PLATE XXVIII

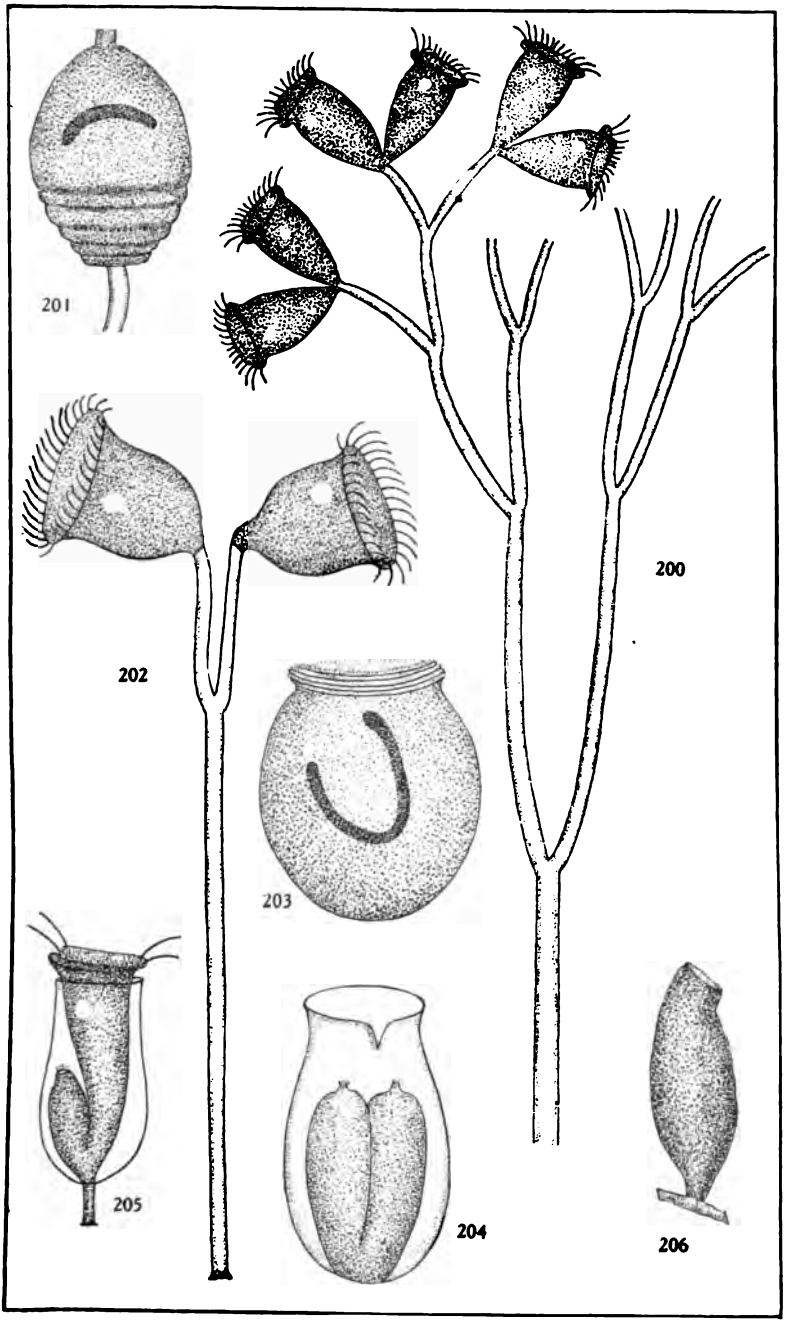


PLATE XXIX.

		PAGE
Fig. 207.	*Sphærophrya magna*, x 620, - - - - -	114
Fig. 208.	*Podophrya fixa*, x 310, - - - - - -	115
Fig. 209.	*Podophrya fixa*, beginning of encystment, x 310,	115
Fig. 210.	*Podophrya fixa*, encystment complete, x 310, -	115
Fig. 211.	*Podophrya quadripartita*, x 310, - - - -	115
Fig. 212.	*Podophrya quadripartita*, attached to the branches of *Epistylis plicatilis*, x 100, - - - - -	115
Fig. 213.	*Podophrya quadripartita*, showing internal embryo not yet extruded, x 310, - - - -	115
Fig. 214.	*Acineta* sp., x 310, - - - - - - -	116

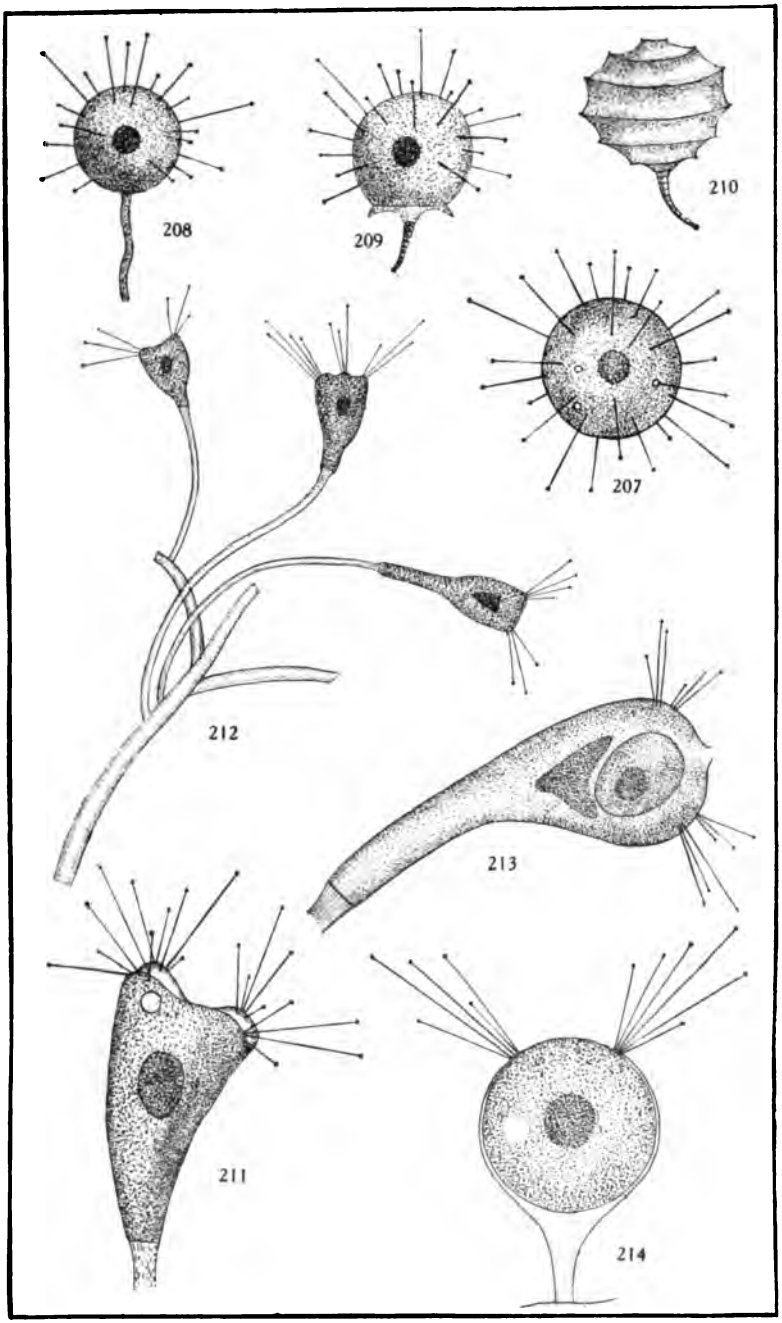
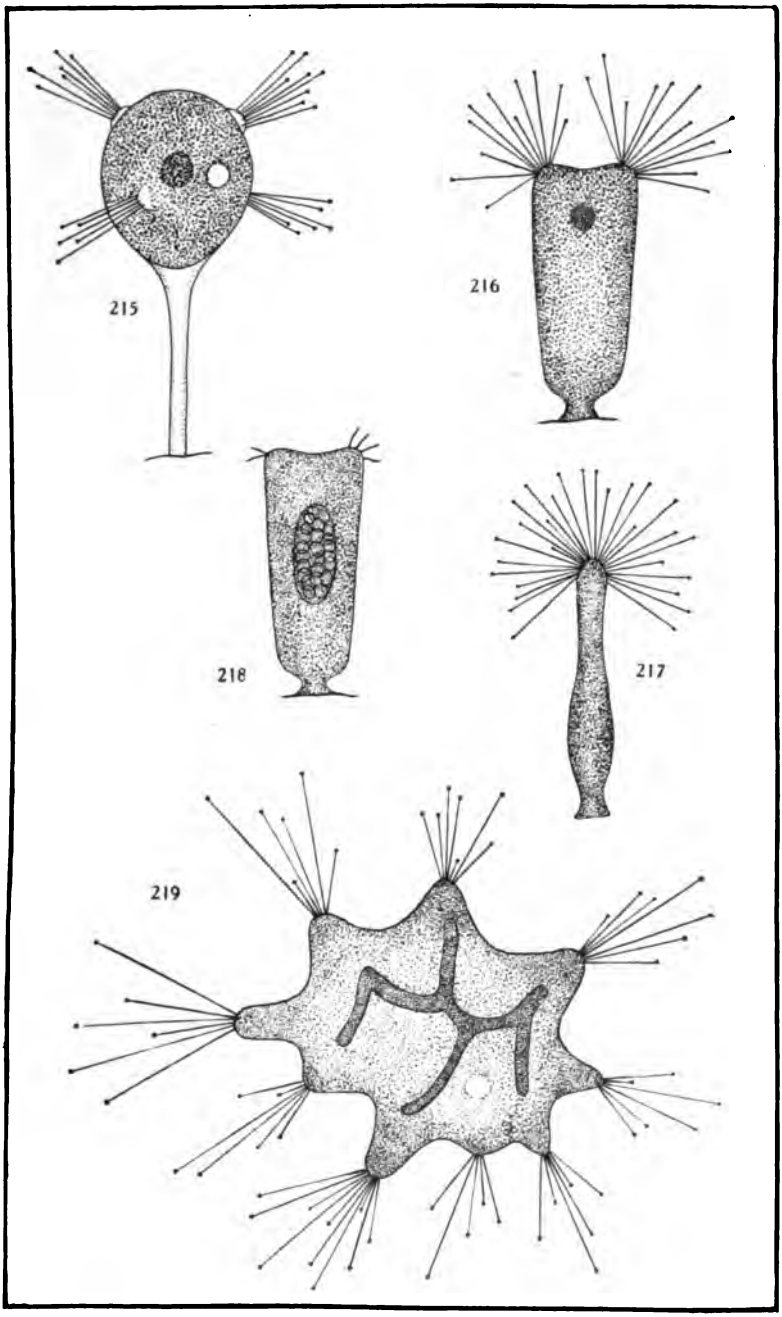

208
209
210
207
212
213
211
214

PLATE XXX.

PAGE.

Fig. 215. *Acineta* sp., x 300, - - - - - - - 117.
Fig. 216. *Hallezia buckei*, x 200, - - - - - - 117
Fig. 217. *Hallezia buckei*, lateral view, x 200, - - - 117
Fig. 218. *Hallezia buckei*, beginning of reproduction, x 200, 117
Fig. 219. *Tricophrya sinuosa*, x 310, - - - - - 118


215
216
218
217
219

PUBLICATIONS OF THE DAVENPORT ACADEMY OF SCIENCES

The Davenport Academy of Sciences commenced the publication of its PROCEEDINGS in 1876. The first ten volumes, together with such separate papers as are not out of print, are for sale, postpaid, at the prices affixed in the following list. Beginning with Volume XI, the PROCEEDINGS will be issued in the form of separate papers, to be distributed as soon as printed.

VOLUME I. Proceedings, 1867-1876. 8vo. 304 pp., 38 plates, 3 text figures. A limited number on hand. Paper, $5.00; cloth, $6.00.

VOLUME II. Proceedings, 1876-1878. 8vo. 364 pp., 13 plates, 24 text figures. Paper, $4.00; cloth, $5.00.

Also the following separates:

Gass, Rev. J.—Explorations of Mound No. 3, Cook's Farm Group. Farquharson, R. J.—On the Inscribed Tablets. 23 pp., 3 plates, 40 cents.

Putnam, J. Duncan—Biological and Other Notes on Coccidæ. I. Pulvinaria innumerabilis. II. Aspidiotus ancylus. 54 pp., 2 plates, 60 cents.

VOLUME III. Proceedings, 1879-1881. 8vo. 314 pp., portrait, 10 plates, 4 text figures. A limited number on hand. Paper, $4.00; cloth, $5.00.

Also separately:

Part 3, Memorial of J. Duncan Putnam, containing his Biography, by Dr. C. C. Parry, and The Sulpugidæ of America, by J. Duncan Putnam. 119 pp., portrait, 4 plates, $2.00.

VOLUME IV. Proceedings, 1882-1884. 8vo., 348 pp., portrait, 5 plates, 111 text figures. Paper, $3.00; cloth, $3.50.

Also the following separate:

Putnam, Charles E.—Elephant Pipes and Inscribed Tablets in the Museum of the Academy. 95 pp., 3 text figures, $1.00.

VOLUME V. Proceedings, 1885-1899. 8vo., 370 pp., portrait, 2 plates, text figures. Paper, $3.00; cloth, $3.50.

Also the following separates:

Call, R. E., and Pilsbry H. A.—On Pyrgulopsis, a New Genus of Rissoid Mollusk, 6 pp., 1 text figure, 1 plate, 20 cents.

Barris, W. H.—A Defense of Our Local Geology. 8 pp., 20 cents.

McGee, W J—Index to Proceedings, Volumes I-V. 89 pages.

VOLUME VI. Proceedings, 1889-1896. 8vo., 392 pp., portrait, 6 plates, 28 text figures. Paper, $3.00; cloth, $3.50.

Also the following separates:

Starr, Frederick.—Bibliography of Iowa Antiquities. 24 pp., 30 cents.

Parry, Charles Christopher, Biographical Sketch of, by C. H. Preston, M. D., together with a list of papers published by Dr. C. C. Parry, prepared by Mrs. C. C. Parry. 17 pp., portrait, 20 cents.

Starr, Frederick.—Summary of the Archæology of Iowa. 71 pp., 24 text figures, 75 cents.

McNeill, Jerome.—Revision of the Truxalinæ of North America. 95 pp., 5 plates, $1.25.

VOLUME VII. Proceedings, 1897-1898. 8vo., 316 pp., portrait, 17 plates, 4 text figures. Paper, $3.00; cloth, $3.50.

Also the following separates:

Putnam, Charles Edwin, A Memoir, by W. C. Putnam. 13 pp., portrait, 20 cents.

Barris, W. H.—Our Local Geology. 19 pp, 20 cents.

Osborn, Herbert and Ball, Elmer D.—Studies of North American Jassoidea. 55 pp., 6 plates, 75 cents.

Starr, Frederick.—Notched Bones from Mexico. A Shell Inscription from Tula, Mexico. 10 pp., 3 text figures, 1 plate, 20 cents.

Osborn, Herbert and Ball, Elmer D.—The Genus Pediopsis. A Review of the North American Species of Idiocerus. 27 pp., 30 cents.

Cockerell, T. D. A.—Contributions to the Entomology of New Mexico. 17 pp., 20 cents.

Scudder, Samuel H.—Supplement to a Revision of the Melanopli. 48 pp., 3 plates, 65 cents.

Wickham, H. F.—Habits of American Cicindelidæ. 22 pp., 25 cents.

Pammel, L. H.—Notes on Grasses of Nebraska, South Dakota and Wyoming. Hume, H. Harold.—Fungi collected in Colorado, Wyoming and Nebraska. 28 pp., 8 plates, 45 cents.

VOLUME VIII. Proceedings, 1899-1900. 8vo., 334 pp., portrait, 2 plates, 73 text figures. Paper, $3.00; cloth, $3.50.

Also the following separates:

Pratt, William Henry, A Biographical Sketch, by C. H. Preston. Pratt, W. H.—A Glimpse Into Our Future. 16 pp., 20 cents.

Scudder, Samuel H.—Catalogue of the Described Orthoptera of the United States and Canada. 100 pp., 3 plates, $1.25.

Starr, Frederick.—Notes Upon the Ethnography of Southern Mexico. (See also Vol. IX.) 90 pp., 10 plates, $1.10.

Barnes, W. D., Reppert, Fred and Miller, A. A.—The Flora of Scott and Muscatine Counties, Iowa. 85 pp., 2 plates, $1.00.

Putnam, Mrs. M. L. D.—Inaugural Address, read before the Academy April 27, 1900. 8 pp., 20 cents.

VOLUME IX. Proceedings, 1901-1903. 8vo., xv+337 pp., portrait, 34 plates, 6 text figures. Paper, $3.00; cloth, $3.50.

Also the following separates:

Scudder, Samuel H., and Cockerell, T. D. A.—A First List of the Orthoptera of New Mexico. 62 pp., 80 cents.

Starr, Frederick.—Notes upon the Ethnography of Southern Mexico. Part II. (See also Vol. VIII.) 102 pp., 3 figures, 9 plates, $1.25.

Shimek, B.—Helicina occulta, *Say*. 8 pp., 20 cents.

Starr, Frederick.—More Notched Bone Rattles. 3 pp., 3 figures, 10 cents.

Pergande, Theo.—North American Phylloxerinæ Affecting Hicoria (Carya) and Other Trees. 88 pp., 21 plates, $1.50.

VOLUME X. Proceedings, 1904-1905. Mary L. D. Putnam Memorial Volume. 8vo. Subscription price, $3.00. [*In press.*]

Also the following separates:

Putnam, Mrs. Mary Louisa Duncan, and Putnam, William Clement, Memoirs, by Elizabeth Duncan Putnam. Portraits. [*In press.*]

Jordon, David Starr and Seale, Alfred.—List of Fishes Collected at Hong Kong by Captain William Finch, with Description of Five New Species. 17 pages, 18 plates, two of them colored, 60 cents.

Calvin, Samuel.—The Aftonian Gravels and Their Relation to the Drift Sheets in the Region about Afton Junction and Thayer. 12 pp., 7 plates, 30 cents.

Pammel, L. H.—A Comparative Study of the Vegetation of Swamp, Clay, and Sandstone Areas in Wisconsin, Southeastern Minnesota, Northeastern, Central and Southeastern Iowa. 94 pp., 42 figures, $1.10.

Cockerell, T. D. A.—Some Coccidæ from the Philippine Islands. 10 pp., 20 cents.

Osten Sacken, C. R.—The Common Drone-fly (Eristalis tenax, *Linn.*). 4 pp., 10 cents.

Fewkes, J. Walter.—Mural Relief Figures on a Mexican Ruin. [*In press.*]

Mac Bride, Thomas V.—On Certain Fossil Plant Remains in the Iowa Herbarium. [*In press.*]

Nutting, C. C.—On Local Museums. [*In press*].

VOLUME XI. Proceedings, 1906. 8vo. Subscription price, $3.00.

Individual papers, issued separately as printed:

Edmondson, Charles Howard.—The Protozoa of Iowa. A Study of Species Known to Occur in the Waters of this State. $1.50.

Anderson, Rudolph Martin.—The Birds of Iowa. [*In press*]

Moulton, Dudley.—The Monterey Pine Scale, Physokermes insignicola, *Craw.* [*In press*].

The Academy exchanges with learned societies and libraries.

Orders for publications of the Academy, whether for sets, volumes, or separate papers, should be addressed: "Davenport Academy of Sciences, Davenport, Iowa, U. S. A." Remittances, whether by draft or money order, should be made payable to "Treasurer, Davenport Academy of Sciences."

MINNESOTA
MAP
OF
IOWA.
Scale of Miles.
1906.
Compiled from Maps of the Iowa Geological Survey, Iowa R.R. Commission &c.
Pat. Anderson, Jr.
SOUTH DAKOTA
NEBRASKA
MISSOURI
ILLINOIS
WISCONSIN
LYON
OSCEOLA
DICKINSON
EMMET
KOSSUTH
WINNEBAGO
WORTH
MITCHELL
HOWARD
WINNESHIEK
ALLAMAKEE
O'BRIEN
CLAY
PALO ALTO
HANCOCK
CERRO GORDO
FLOYD
CHICKASAW
FAYETTE
CLAYTON
PLYMOUTH
CHEROKEE
BUENA VISTA
POCAHONTAS
HUMBOLDT
WRIGHT
FRANKLIN
BUTLER
BREMER
BUCHANAN
DELAWARE
DUBUQUE
WOODBURY
IDA
CALHOUN
WEBSTER
HAMILTON
HARDIN
GRUNDY
BLACK HAWK
CRAWFORD
CARROLL
GREENE
BOONE
STORY
MARSHALL
TAMA
BENTON
LINN
JONES
JACKSON
CLINTON
MONONA
HARRISON
SHELBY
AUDUBON
GUTHRIE
DALLAS
POLK
JASPER
POWESHIEK
IOWA
JOHNSON
CEDAR
SCOTT
MUSCATINE
POTTAWATTAMIE
CASS
ADAIR
MADISON
WARREN
MARION
MAHASKA
KEOKUK
WASHINGTON
LOUISA
DES MOINES
HENRY
MILLS
ADAMS
UNION
CLARKE
LUCAS
MONROE
JEFFERSON
VAN BUREN
LEE
FREMONT
PAGE
TAYLOR
RINGGOLD
DECATUR
WAYNE
APPANOOSE
DAVIS
OTOE
JOHNSON
NEMAHA
ATCHISON
HOLT
NODAWAY
WORTH
HARRISON
MERCER
PUTNAM
SCHUYLER
SCOTLAND
CLARK
Lower Boundary of Transition (Alleghanian) and Upper Boundary of Upper Austral (Carolinian) Life Zones
Southern Boundaries of Glacial Drift Areas — All south of these lines is the Loess Drift Area.
Stations from which Reports were received

PROCEEDINGS OF THE DAVENPORT ACADEMY OF SCIENCES
Davenport, Iowa, March, 1907 Vol. XI, Pages 125-417

THE BIRDS OF IOWA.

By RUDOLPH MARTIN ANDERSON.

A THESIS

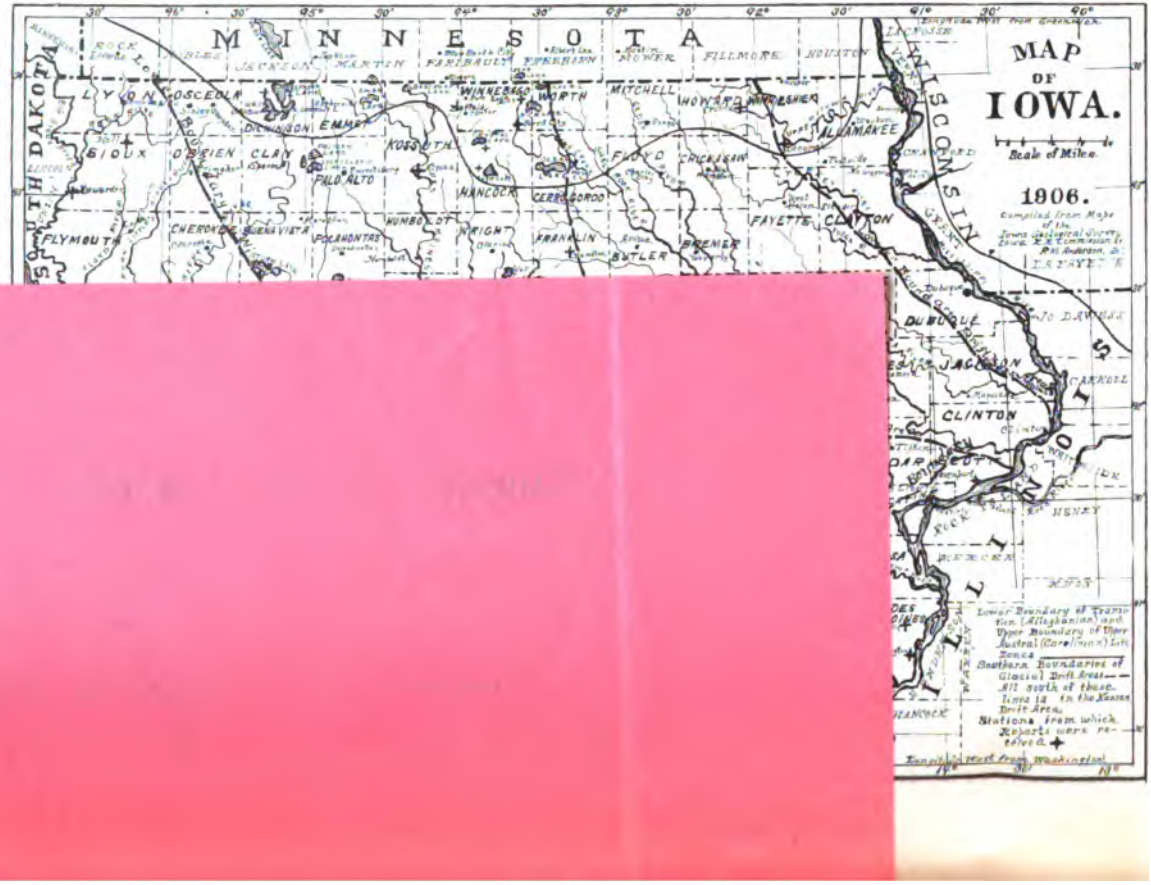
Submitted to the Faculty of the Graduate College of the State University
[illegible] of the Requirements for the
[illegible]ophy.

Davenport Academy of Sciences

Volume X of the PROCEEDINGS of the Davenport Academy of Sciences is at length nearing completion, and will be ready for distribution about July 1st.

n the various branches
new observers who are
cient reasons for a work
only by long-continued
ized areas can the great
ecology be satisfactorily
ies, counties and states
ith approximate exact-
e been neglected, either
ure to make public what

the birds of neighboring
follows: Kansas (Goss,
92); Minnesota (Hatch,
(Ridgway, 1895); Ohio,
); Wisconsin (Kumlien
, Wolcott, and Swenk,
udents in Iowa has been
ous and voluminous, the
s and scientific periodi-
e majority of ornitholo-
lists which treat of the


MINNESOTA
SOUTH DAKOTA
ILLINOIS
WISCONSIN
MAP
OF
IOWA.
Scale of Miles.
1906.
Compiled from Maps of the Iowa Geological Survey, Iowa R.R. Commission, and
PHI Anderson, Jr.
LYON
OSCEOLA
DICKINSON
EMMET
WINNEBAGO
WORTH
MITCHELL
HOWARD
WINNESHIEK
ALLAMAKEE
SIOUX
O'BRIEN
CLAY
PALO ALTO
KOSSUTH
HANCOCK
CERRO GORDO
FLOYD
CHICKASAW
PLYMOUTH
CHEROKEE
BUENA VISTA
POCAHONTAS
HUMBOLDT
WRIGHT
FRANKLIN
BUTLER
BREMER
FAYETTE
CLAYTON
DUBUQUE
JACKSON
CLINTON
HENRY
Lower Boundary of Transition (Alleghanian) and Upper Boundary of Upper Austral (Carolinian) Life Zones
Southern Boundaries of Glacial Drift Areas. All north of these lines is in the Kansan Drift Area.
Stations from which Reports were received.
Longitude West from Washington

PROCEEDINGS OF THE DAVENPORT ACADEMY OF SCIENCES
Davenport, Iowa, March, 1907 Vol. XI, Pages 125-417

THE BIRDS OF IOWA.

By RUDOLPH MARTIN ANDERSON.

A THESIS

Submitted to the Faculty of the Graduate College of the State University of Iowa, in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy.

PREFACE.

The continued and increasing interest in the various branches of zoölogical science, and the number of new observers who are entering the field of ornithology, are sufficient reasons for a work of this kind. It is well recognized that only by long-continued observations of the faunae of certain localized areas can the great problems of distribution, migration, and ecology be satisfactorily explained. While a few favored localities, counties and states have had their avi-fauna mapped out with approximate exactness, other equally important districts have been neglected, either from lack of competent observers or a failure to make public what has been accomplished.

Within the past few years state lists of the birds of neighboring commonwealths have been published as follows: Kansas (Goss, 1891, Lantz, 1899); Indiana (Butler, 1892); Minnesota (Hatch, 1892); Michigan (Cook, 1893); Illinois (Ridgway, 1895); Ohio, (Jones, 1903); Wyoming (Knight, 1902); Wisconsin (Kumlien and Hollister, 1903); Nebraska (Bruner, Wolcott, and Swenk, 1904). While the list of ornithological students in Iowa has been large, and their printed notes are numerous and voluminous, the publication of the same in scattered books and scientific periodicals has rendered them inaccessible to the majority of ornithologists in the state. The only published lists which treat of the

birds of Iowa as a whole are the nominal unannotated catalogues of J. A. Allen (1870) and Herbert Osborn (1892), and the preliminary annotated catalogue by Chas. R. Keyes and H. S. Williams in 1889.

Feeling the need for a state catalogue of Iowa birds which should embody the latest results of field work and conform to the present accepted code of nomenclature, the writer began to collect material for the present volume in the fall of 1903, as a graduate student at the State University of Iowa. The library of the department of zoölogy and the Talbot collection of books in the general library of the University, the latter rich in books of early North American travel and rare scientific volumes, were quite well supplied with the necessary bibliographical material, and through the courtesy of the library authorities a number of rare books were obtained from the Library of Congress in furtherance of the work.

The Museum of Natural History of the State University of Iowa is particularly rich in birds, containing the collections of C. C. Nutting, Frank Bond, Dr. Horr, D. H. Talbot, and others. The Talbot collection, donated by Mr. D. Talbot of Sioux City, comprises several thousand specimens and many exceptionally large series, chiefly from the Mississippi Valley, which are invaluable in determining the status of certain disputed forms. The writer's small private collection and field notes, running from the year 1890 to the present time, have also been freely used.

Great indebtedness is acknowledged to Dr. Paul Bartsch of the Smithsonian Institution, whose unpublished thesis on "The Literature of Iowa Birds," giving a quite complete list of the papers relating to Iowa birds, published annually from 1804 to 1899, furnished me with many bibliographical hints. All references used in the present work were personally verified from the original sources by the writer.

In pursuance of the line of work adopted, about one hundred check lists of North American birds were sent out to persons interested in ornithology throughout the state, requesting them to mark such species as were found in their respective localities, and furnish notes respecting their relative abundance, migrations, nesting, etc. A list of those who kindly contributed notes and other assistance will be found elsewhere.

In presenting this work the writer desires to express his great obligation and gratitude to Professor C. C. Nutting for continued encouragement and assistance, as well as the liberal extension of facilities, including free access to material and specimens necessary to carry on the work; and to Professor H. F. Wickham for valuable literature and notes furnished, and for helpful suggestions and criticism. Mr. Robert Ridgway, curator of birds, United States National Museum, very kindly identified some sixty-seven specimens which were submitted to him for examination, while Dr. B. H. Bailey, professor of zoölogy at Coe College, very kind ly permitted me to make extended examinations of the collections in that institution.

In the main, the nomenclature adopted in the following list is that of the American Ornithological Union Check List, Second Edition, and Supplements succeeding. In a few cases I have been impelled to follow the nomenclature of Robert Ridgway's "Birds of Middle and North America," Vols. I–III.

INTRODUCTION.

SCOPE.

The limits of these pages forbid any attempt to introduce descriptions of species. All of the species and subspecies of North American birds have been so completely and minutely described by numerous and readily accessible authorities that an effort to add descriptions to a faunal list means simply added bulk and repetition of work. With the different species already well characterized and delimited, the province of a work of this kind should be to add some contributions to our knowledge of their habits and economic relations, their migrations; to trace their local distribution and comparative abundance at the present time, and to determine, if possible, what changes the rapid growth of settlement and civilization have wrought in our avi-fauna during the comparatively brief period since the settlement of our state; what species have been compelled to succumb, and what species have succeeded in adapting themselves to the radical change in environment which has almost universally taken place.

HISTORICAL WORK.

The earliest references which can be identified as relating to birds actually observed within the present limits of the state of Iowa are found in the history of the Lewis and Clark Expedition, which journeyed up the Missouri River during the summer of 1804 and returned by the same route in the fall of 1806. Dr. Elliott Coues, in his copious and critical notes upon this history,[1] has identified many of the species mentioned in the narrative, and referred them to various points on the banks of the Missouri in western Iowa.

The next contribution to Iowa ornithology was made by the

1. History of the Expedition under the command of Lewis and Clark to the source of the Missouri River, thence across the Rocky Mountains to the Pacific Ocean, performed during the years 1804-5-6, by order of the Government of the United States. A New Edition. Faithfully reprinted from the authorized edition of 1814, by Elliott Coues. Four vols. Francis P. Harper. 1893.

noted naturalist, Thomas Say,[1] who with Major Long's exploring party remained from September 19, 1819, to June 6, 1820, at Engineers' Cantonment, on the west bank of the Missouri, about half a mile above Fort Lisa, five miles below Council Bluffs, and three miles above the mouth of Boyer's River—41° 25′ 03.9″ N. Lat. and 95° 45′ 50″ W. of Greenwich. He gives a catalogue of animals, which were observed at Engineers' Cantonment, or at other indicated places, on the journey to that post. One hundred forty-three species were observed at Engineers' Cantonment. He also makes observations relative to the arrival and departure of birds at Engineers' Cantonment.

The ascent of the Missouri River in 1833, and descent in 1834, by Maximilian Prince of Wied,[2] furnished notes on thirty-four species of Iowa birds.

The veteran ornithologist, John James Audubon, touched upon Iowa territory in his journey up the Missouri River in 1843.[3] Most of the species mentioned are not very clearly distinguishable as Iowa or Nebraska records, from the inadequate description of landing places.

The works of Baird, Cassin and Lawrence[4] (1858), Baird's "Birds of North America" (1860), Baird, Brewer and Ridgway's "History of North American Birds" (Land Birds, 1874, Water Birds, 1884), and other memorable works contain many scattered references to Iowa birds.

John Krider's "Forty Years' Notes of a Field Ornithologist" (Philadelphia, 1879), contain many notes on Iowa birds. He collected in Iowa at various times from 1870 to 1875, and while many inaccuracies appear in his published works there is much of interest in them from the fact that they were made when north-

1. Account of an Expedition from Pittsburg to the Rocky Mountains, performed in the Years 1819-1820, by order of the Hon. J. C. Calhoun, Secretary of War, under the command of Maj. S. H. Long of the U. S. Topographical Engineers. Compiled from the notes of Major Long, Mr. T. Say, and other gentlemen of the party, by Edwin James, botanist and geologist to the Expedition. In three volumes. I, II, III. London: Printed for Longman, Hurst, Reese, Orme & Brown. Paternoster Row. 1823.

2. Reise in das Innere Nord America in den Jahren 1832 bis 1835 von Maximilian Prinz zu Wied. Coblenz: Vol. I, 1839. Vol. II, 1843.

3. Audubon and His Journals. By Maria R. Audubon, with zoölogical and other notes by Elliott Coues. Vols. I-II. New York: Chas. Scribner's Sons. 1897. Vol. I, pp. 474-480. Vol. II, pp. 170-172.

4. Reports of Explorations and Surveys to ascertain the most practical and economical route for a railroad from the Mississippi River to the Pacific Ocean. Made under the direction of the Secretary of War, in 1853-6. Vol. IX. Washington: A. O. P. Nicholson, Printer. 1858.

ern Iowa was practically an unsettled prairie, with abundant marshland, and the habits and relative abundance of species differed materially from the conditions of the present day, with a farm on almost every quarter-section, large planted groves, and the sloughs and marshes largely drained or naturally dried up. Mr. Krider's notes on Iowa birds are particularly interesting to the writer from having been made principally in Winnebago county, where most of his own early observations were made. I have heard old settlers tell many tales of Mr. Krider and the great quantities of birds collected by him in Winnebago county.

The first formal list which was exclusively Iowan appeared in White's Geology of Iowa in 1870.[1] This enumerated 283 species, not annotated. Ninety-two species were marked as having been observed within or near the borders of the state in the breeding season.

An impulse was given to ornithological work in Iowa by the efforts of Professor W. W. Cooke, in 1881–2, to secure the assistance of the ornithologists of Iowa in studying the migrations of birds. In 1883 the scope of the work was extended to include the whole Mississippi Valley, four observers reporting from Iowa. In 1884 twenty-six observers sent reports from eighteen stations in Iowa. In 1885 fourteen new observers reported from Iowa. These collected records form a valuable contribution to the study of migration.[2]

In 1889 Charles R. Keyes and Dr. H. S. Williams published a Preliminary Annotated Catalogue of the Birds of Iowa.[3] This included brief notes on 262 species, mostly observed in the vicinity of Charles City, Des Moines, and Iowa City, the dates of arrivals and departure being based entirely upon studies conducted in the vicinity of Des Moines, a place of central location, representing nearly a mean for the arrivals and departures over the whole state.

Herbert Osborn's "Partial Catalogue of the Animals of Iowa Represented in the Collections of the Iowa Agricultural College" (1892), contains a list of birds condensed from the catalogue of Keyes and Williams.

1. Report on the Geological Survey of the State of Iowa, by Charles A. White. Vol. II. 1870. Appendix B. A Catalogue of the Birds of Iowa, by J. A. Allen, pp. 419-427.

2. Bird Migration in the Mississippi Valley in the Years 1884 and 1885, by W. W. Cooke. U. S. Department of Agriculture, Division of Economic Ornithology. Bulletin No. 2. 1888.

3. Proc. of the Davenport Academy of Natural Sciences, Vol. V, pp. 113-161. 1889.

The founding of the Iowa Ornithologists' Association in 1894 revived interest among the bird students of the state. About fifty members were enrolled, and a quarterly journal, called *The Iowa Ornithologist*, was published for some four years. Several families of birds were studied in detail, and the aggregated notes were published in the official organ. A committee was appointed to collect material for a book on the birds of Iowa, but with the demise of the association, in 1899, the work was allowed to drop.

A list of the more important publications which contain references to Iowa birds will be found in the bibliographical appendix.

RELATIVE ABUNDANCE.

The relative abundance of the different species has been generally arrived at from the statements of published authorities and from about thirty local and county lists which have been furnished by bird students scattered over the greater portion of the state. In work of this kind the compiler finds his greatest difficulties arising from the lack of a definite system for recording the relative abundance or scarcity of species in a given locality. The amount of time spent in the field, the topography of the region covered, the season of observation, and the personal equation of the observer, have a great effect upon the records made. It is evident that if most of the time be spent in woodlands, the swamp- and prairie-loving species will be seldom seen, and if field excursions are made only at irregular and infrequent intervals, some of the migrant species which spend only a few days with us may be entirely overlooked. Unfamiliarity with songs and notes may cause the omission of certain secretive species. The classification of a species as "rare" by a trained and indefatigable observer would be much more conclusive than such a characterization by a student who spent but little time in the field. For these reasons more or less discrepancy is frequently found in the reports of accurate and conscientious observers working in very similar localities. Thus it is only when the reports of all observers substantially agree, that the records may be considered as more than approximately accurate.

The definition of terms used to indicate relative abundance by

Professor Lynds Jones in his "Birds of Ohio"[1] may well be followed as indicating the mean of expression by the average student of birds.

"In a general way the term 'abundant' signifies that the species to which it is applied are so numerous as to force themselves upon one's notice. The English Sparrow is the only bird to which this term can be applied the year through." The Robin may be considered abundant in summer in most localities, while the Red-winged Blackbird may be abundant in swampy districts and wholly absent from other localities near by.

"A species is regarded as 'common' when a considerable number of individuals may be found without much effort or expenditure of time." The Chickadee may be regarded as common in woodland throughout the year. The Catbird is common in most localities in summer.

"'Tolerably common' is used to indicate the fact that the individuals of the species designated are so few that they must be searched for under normal conditions, and yet present in the region." The Scarlet Tanager may be regarded as tolerably common in woodlands throughout the state.

"'Rare'" is the term reserved for a species which is represented by so few individuals that a record of its occurrence is regarded as unusual." The Golden Eagle is generally rare in Iowa, more than one or two records of its appearance in a year being unusual in a given locality.

"'Casual' means that the species to which it is applied visits the state only under unusual circumstances." Thus the Great Gray Owl could not be expected to reach Iowa except during an unusually severe winter when its food supply in the north failed. Casual stands very close to accidental. A Red-tailed Hawk would be casual in a city park, because that park lies within its range in the surrounding region. A Bullock Oriole would be accidental there because its home is in regions far removed.

"In the use of any of these terms except 'casual,' account must be taken of the habits of the birds. Account must also be taken of the size of the birds to which the terms are applied in each instance. Thus a dozen Red-tailed Hawks in a township would

1. Ohio State Academy of Science. Special Papers, No. 6. The Birds of Ohio. A Revised Catalogue. by Lynds Jones, M. Sc. Oberlin College. Published by the Academy of Science with the Emerson McMillan Research Fund. October 15, 1903.

make that hawk appear almost abundant, while a dozen Chipping Sparrows or Robins in that same township would be almost rare for these species."

BREEDING.

While, in general, the presence of individuals of a species in a given locality during the summer is considered indicative of their breeding there, such evidence is not always to be taken as *prima facie* proof of the fact. Many unmated birds wander far from their usual summer habitat, and wounded birds may be unable to make the journey northward in spring. Various species of Sandpipers linger in the Northern Iowa marshes until after June 1, and large numbers frequently move southward into the state early in July. Some of the southern species of Herons frequently wander far north of their breeding range in late summer and early autumn. Many species, notably among the Ducks and Geese, which are known to have nested commonly in Iowa a few years ago, very seldom do so at the present time. On the other hand, the extensive planting of groves in treeless prairie regions has induced many woodland species to make their summer homes in localities where they were absent a few years ago. Therefore, generalizations in the matter of nesting habits become very difficult, owing to the rapid and complicating change of conditions, and deductions based upon the records of a few years ago are apt to be erroneous and misleading.

FOOD.

The question of the food of birds is one which is probably of the most importance economically. It is universally conceded that the great majority of species are directly beneficial, and in many cases indispensable, to agriculture and horticulture, either by destroying noxious insects or the seeds of weeds, while but a few are directly injurious by feeding upon fruits and grains, preying upon poultry, game birds, and valuable small birds, or indirectly by destroying insects which are in some measure beneficial to agriculture. Even those birds which are generally regarded as injurious, as the Hawks and Owls, have been proved to more than balance their account by the destruction of multitudes of the vermin which prey upon the crops of the farmer. A

discussion of the food habits will usually be placed under the heading of the order or family.

MIGRATION.

The proper study of migration requires voluminous data from many observers, extending over long periods. The position of the State of Iowa, between the two great channels of migration for the interior of the United States, affords unequaled opportunities for such work. The data which has been received in this branch has been too scanty and isolated to warrant more than general statements of the times of appearance and departure.

The Biological Survey of the United States Department of Agriculture has for nearly twenty years been accumulating data on the migration of birds, receiving reports in the spring and fall of each year from hundreds of observers. The Yearbook of the Department of Agriculture for 1903, pp. 371–386, "Some New Facts About the Migration of Birds," by Wells W. Cooke, Assistant, Biological Survey, contains the following statement:

"For more than two thousand years the phenomena of bird migration have been noted, but while the extent and course of the routes traveled have of late become better known, no conclusive answer has been found to the question, why do birds migrate? . . . The broad statement can be made that the beginnings of migration ages ago were intimately connected with periodic changes in the food supply, but this motive is at present so intermingled with others unknown, or but imperfectly known, that the migration movements seem now to bear little relation to the abundance or absence of food. . . . Data recently collected at the Florida light-houses by the Biological Survey show that southward migration begins at least by the 10th, and probably by the 1st of July, insect-eating birds departing when their food supplies are most plentiful, and seed-eaters just before the heyday of harvest."

It is undoubtedly true that many birds return to the far north during the breeding season in order to find undisturbed solitude during the season of incubation and moulting. The northward retreat of the ducks and geese which nested commonly in Iowa before its settlement, tends to confirm this. On the other hand, many common birds return to breed in thickly populated localities here, leaving southern points which would apparently supply greater seclusion and an equal food supply.

Among day migrants, according to Mr. Cooke, sight is probably the principal guide, and undoubtedly plays a part in guiding the night journeys also, it being noticeable that they pass higher overhead on clear, bright nights, flying lower on dark, cloudy nights. He believes that they also possess a power, whatever its nature, that may be called a "sense of direction," which serves to guide them unerringly over ocean wastes. "The truth seems to be that birds pay little attention to natural physical highways except when large bodies of water force them to deviate from the desired course. Probably there are many short zigzags from one favored feeding ground to another, but the general course between the summer and winter homes is as straight as the birds can find without missing the usual stopping places."

Commenting on the above, Dr. J. A. Allen[1] says:

"It does not follow, however, that because all the birds of a district do not concentrate and move in masses along river valleys and coast lines, that they are not guided in their courses by the prominent features of the landscape, even in the case of those species which pass from the upper Mississippi Valley to the coast of South Carolina and Georgia. Nor is it true that river valleys, etc., do not form migration routes for many species of birds."

The general north and south direction of the rivers and streams of the state and its boundaries renders this particularly true in Iowa. The Mississippi River on the east and the Missouri on the west form the main routes, from which in the eastern part of the state the wave of migration diverges in general to the northwest, following the trend of the larger tributaries of the Mississippi, while in the western part of the state the streams flowing into the Missouri lead it somewhat northeasterly. The water birds naturally follow the streams, while the land birds, as a rule, frequent the natural woodland, which in a prairie state, reaches its greatest luxuriance as a fringe along the watercourses.

The migration of most land birds in Iowa is fairly constant in spring and fall, while the migration of water birds is apt to fluctuate, both in course and numbers, particularly in the spring flight. The great variation in the numbers of the spring flight from year to year has been explained by the hypothesis that when

1. Aux, xxi, 4, 1904.

the Mississippi is open at the time the van-guard reaches Iowa, the water birds are apt to follow its channel in greater numbers, barely touching the borders of Iowa, while if the Mississippi is blocked by ice in early spring, the flight may be diverted into the valleys of the Des Moines, Iowa, and Cedar rivers, and a larger number reach the interior of the state.

Throughout most of north central and northern Iowa, migration is more diffused. As has been pointed out by Mr. Wilmon Newell,[1] in the region of the Wisconsin drift sheet, the uneven dumping of the drift has resulted in lulls and moraines, and numerous swales or marshy ponds. "The southern limit of the region being near Des Moines, on the Des Moines River, the spring migration of the *Rallidæ*, *Gallinulidæ*, *Scolopacidæ*, and, to a certain extent, that of the *Anseres*, is diverted from the river valleys to this territory, and passes through central Iowa to the northern Iowa and Minnesota lakes. In the autumn, most of the ponds being dried up, the same birds follow almost exclusively the river channels. However, the summer residents of the pond region take their way southward over the prairie region, following the line of their spring migration."

This diffusion of the line of migration evidently induces a more leisurely journey toward the north, the birds stopping to rest and feed along the way. This appears to explain the conditions noted by W. W. Cooke (Bird Migr. in Miss. Val., 1884-5, pp. 61-5):

"During the spring migration of 1884 it was noted by Mr. Miller that ducks came to Heron Lake, Minn., not far from the Iowa line, from the west, as if they were a part of the Missouri River flight. In 1885 they must have come from the same direction, since in the region south of Heron Lake, in Iowa, in an equally favorable locality (Emmetsburg), none were seen until about two weeks later. There can be no doubt that in the spring of 1885 the flight of ducks and geese along the Missouri River was several days earlier than at corresponding latitudes along the Mississippi River."

While it is true that apparently delicate species of birds are able to endure great extremes of temperature without apparent discomfort, their occurrence and abundance is closely related to the climatic conditions and food supply of the region. Graniv-

1. "Topography as Influencing Migration," Western Ornithologist, v. iii, 1900, 58-9.

orous birds are dependent upon the plants and insectivorous birds upon the insects which appear with the rejuvenescence of plant life. Through its effect upon the flora, therefore, climate has an indirect but intimate effect upon the movements of most birds, with the exception of a few resident species whose diet and source of food supply are only slightly affected by the season.

RANGE IN IOWA.

The range of the different species in the state has been taken largely from the reports received from numerous observers, from specimens in various collections, and from all available published records. The following rule has been adopted for the admission of a species to a state list: A specimen of the species must have been captured within the limits of the state and preserved, or critically examined by some person familiar with the species, or capable of making a positive identification. A local or county record, if casual or accidental for the region, must be substantiated by a specimen captured and critically examined, or if conspicuously marked, observed under favorable conditions by one familiar with that species.

I have been compelled to omit some species from lists which have been furnished me, as well as to relegate to a State Hypothetical List some species which have been reported on insufficient evidence as occurring in the state. The wide-ranging habits of birds, and the facilities for extended locomotion possessed by them, make the occurrence of extra-limital species possible at almost any time or place, and render the criticism of any observer's records extremely unsafe. Experience has shown, however, that additions are easily made to a faunal list, while errors seem to have a facility in indefinitely perpetuating themselves.

TOPOGRAPHY OF IOWA.

The state of Iowa is situated between 40° 20′ and 43° 30′ north latitude and 90° 15′ and 96° 43′ west longitude. Its extreme length is from east to west, about 328 miles, its greatest width from north to south, about 215 miles. Its area is approximately 55,475 square miles. The following extracts are taken from a chapter

on the "Physiography of Iowa," by Professor Samuel Calvin, State Geologist of Iowa:[1]

"The state is simply an extensive plain—over large areas a very monotonous plain—lying between the great rivers and rising but little above them at any point. The relief is small. The zero point on the river gauge at Keokuk has an elevation above tide of 477 feet; the elevation at Sibley, the highest important railway station in Iowa, is 1,572 feet. It is probable that Ocheyedan mound or some of the morainic prominences in Osceola county rises 100 feet higher than Sibley, but even then there is less than 1,200 feet of difference between the lowest and the highest points in the state.

"On the eastern border of the state the Mississippi flows in a gorge, which at New Albin and Lansing, measured from the summit of the bluffs facing the valley, is 400 feet in depth. . . The depth of the Mississippi gorge diminishes toward the south. The valley of the Missouri is very different from that of the Mississippi. It is bordered by a series of high bluffs unique in appearance, and more unique in structure, for they have been built up largely of fine dust transported by the winds. The constantly shifting meanders of the stream and the great width of the alluvial flood plain are among the striking characteristics of this peculiar valley.

"Another of the larger topographic features is the great watershed. This is the ill-defined ridge which extends in a sinuous course from Dickinson county to Wayne and forms the line of parting between the waters flowing to the Mississippi on the one side and to the Missouri on the other. The watershed is in reality the southward extension of the noted ridge of the Dakotas and southwestern Minnesota, known as the Coteau des Prairies. An area somewhat greater than two-thirds of the state lies east of the watershed; less than one-third lies on the west.

"On the basis of the effect produced by the great ice sheets of the glacial epoch, the surface of Iowa may be divided into two parts, to be known respectively as the Driftless Area and the Drift-covered Area."

The Driftless area covers only a small area—Allamakee and portions of Winneshiek, Fayette, Clayton, Dubuque, and Jackson counties. It is a land of thin soils, high, rocky precipices, long, steep hills and deep rock-cut valleys. The Drift-covered area occupies much the larger portion of the state. It presents four well-defined areas, each having at the surface a sheet of drift

1. Atlas of the State of Iowa. Published under the direction and supervision of M. Huebinger, C. E. By the Iowa Publishing Co., Inc. Davenport, Iowa. 1904. P. 258.

differing in age, and to some extent in origin from the drift of either of the others.

The Kansan drift covers the greater part of southern, south-central and western Iowa. Its whole surface has been carved and shaped by flowing water and developed into an intricate system of rounded hills and ridges separated by steep-sided ravines. Every foot of the surface is thoroughly drained. A more level surface is found in the small area covered by the Illinoian drift in Scott, Muscatine, Louisa, Des Moines, Henry, and Lee counties in southeastern Iowa.

Embracing Buchanan, Blackhawk, Bremer, Chickasaw, Mitchell and a number of other counties in northeastern Iowa, is an area of what is known to geologists as the Iowan drift. There has been practically no erosion, the streams flow in narrow, shallow trenches, and before the settlement of the region there were extensive undrained sloughs.

The youngest drift area is the Wisconsin drift, covering a triangular lobe extending down from Minnesota, the base extending from Worth county to Osceola, the apex at Des Moines. Over the greater part of the Wisconsin plain even the rudiments and beginnings of effective drainage have not yet been established, and marshes and sloughs are abundant. The Wisconsin, more than any of its predecessors, was a moraine-forming ice sheet. Part of the transported materials was piled up around the margin of the lobe in a bewildering series of disorderly hills or knobs, varying from eighty to one hundred and fifty feet in height.

"Intimately related to the subject of Wisconsin moraines are the many charming lakes of Iowa. There are no lakes worthy of note in the Kansan, Illinoisan or Iowan areas. All of our lakes are of Wisconsin age, and most of them occupy basins in the irregularly-piled morainic ridges. . . . Clear Lake lies in such a basin in the eastern moraine, surrounded by prominent constructional hills and knobs. Spirit Lake, the Okobojis, and a number of beautiful but less important sheets of water in the same part of the state, are all located in an extensive morainic belt belonging to the recessional series."

CLIMATE OF IOWA.

"Climatology of Iowa." From Annual Report of Iowa Weather and Crop Service. By John R. Sage, Director. (Atlas of Iowa):

"Too far inland to receive the equalizing effects of winds blowing directly from the ocean, the climate of Iowa is strictly continental in type. This implies a very wide range of temperature, winters of considerable severity, summers of almost tropical heat, and a large percentage of sunshine as compared with insular regions. As there are no mountain ranges nor considerable differences in the altitude of the several sections, the climate of the state is quite homogeneous."

The records of the Iowa Weather and Crop Service for the past thirteen years show the average amount of rainfall precipitated to have been 31.07 inches. The southeast district has a yearly average of 5.49 inches more than the northwest district and 1.05 inches more than the southwest district. The average annual rainfall of the three Mississippi River districts is 30.04 inches. These figures show a quite regular gradient of decrease in yearly amount of rainfall from south to north as well as from east to west.

"The mean temperature of the state is 47.5°. By sections the mean temperatures are as follows: Northern section, 45.7°; central section, 47.3°; southern section, 50°.

"In this part of the Mississippi Valley the summers are warmer and the winters colder than on the same parallels near the Atlantic coast. In July the 75° isotherm passes through the southern half of Iowa, dips southeastward below Cincinnati, passing between Baltimore and Philadelphia. The mean maximum of the state for July is 85°, and the midsummer temperature is about as high as that of Virginia and North Carolina. In January the larger part of Iowa is within the isothermal belt 15° to 20°. These lines run northeastward through northern Michigan, Ontario, northern New York, Vermont, New Hampshire, and Maine. The midwinter temperature corresponds to that of the vicinity of Montreal, while the summers are as warm as at Washington, D. C., and Richmond, Va. The winters, however, are shorter than in the same latitude in the Atlantic states. The transition from winter to summer is usually quite rapid, the average increase in temperature in April being more than half a degree daily. The daily mean of April is 17° higher than that of March, and May averages 11° per day higher than April. . . . The records of the United States Weather Bureau, covering a period of about thirty years, show that the average date of the latest killing frost in the spring has been April 20th, and the earliest in autumn October 9th. In every season there have been light frosts at later and ealier dates, causing no appreciable damage to vegetation.

"A distinctive feature of the climate as compared with the

eastern states is the large percentage of clear skies in the winter season. . . . For the year the average of the state is as follows: 156 clear, 107 partly cloudy, and 102 cloudy days."

FAUNAL AREAS.

Dr. C. Hart Merriam has shown[1] that the continent of North America is divided into three primary life regions—Boreal, Austral, and Tropical—each of transcontinental extent. Their boundaries are sinuous, conforming to the distribution of temperature. The Austral region is likewise sub-divided into three transcontinental zones: (1) a Transition zone; (2) an Upper Austral zone; (3) a Lower Austral zone; each of which may be sub-divided in an east and west direction into two or more areas, some of which are based on humidity instead of temperature. The eastern ends of these three belts have long been recognized by zoölogists, and are known as the Alleghanian, Carolinian, and Austroriparian faunas. Dr. Merriam's map included the greater part of Iowa in the Carolinian fauna, an eastward extension or loop of the Great Plains fauna covering the northwestern corner of the state and part of southwestern Minnesota.

In a later paper[2] Dr. Merriam maps the northern boundary of the humid division of the Upper Austral (Carolinian) fauna as passing from central South Dakota across southwestern Minnesota, crossing the western part of the Iowa-Minnesota line, dipping down into Northern Iowa, crossing the Minnesota line again not far from the Mississippi, following the Mississippi bottoms a short distance into southeastern Minnesota, passing down across the southwestern corner of Wisconsin, extending a small loop into northern Illinois, then passing some distance up along the lake shore in southeastern Wisconsin. The eastern or humid division of the Transition (Alleghanian) zone covers only a small strip in the extreme northern part of Iowa, not more than two or three counties deep in its widest portion, extending from about the western third of the state line almost to the Mississippi River.

In "the eastern humid or Alleghanian area . . . the chestnut, walnut, oaks and hickories of the south meet and overlap the

1. "The Geographic Distribution of Animals and Plants in North America." Yearbook of the U. S. Department of Agriculture. 1894. Pp. 203-214.

2. Bulletin No. 10. U. S. Dept. of Agriculture. Division of Biological Survey. Life Zones and Crop Zones of the United States. By C. Hart Merriam, Chief, Biological Survey. Washington: Government Printing Office. 1898.

beech, birch, hemlock, and sugar maple of the north; the southern mole and cottontail rabbit meet the northern star-nosed and Brewer's moles and varying hare, and the southern bobwhite, Baltimore oriole, bluebird, catbird, chewink, thrasher and wood thrush live in or near the haunts of the bobolink, solitary vireo, and the hermit and Wilson's thrushes. . . . The northward prolongations of southern zones do not carry the complete faunas and floras of the areas to which they belong, but lack certain species from the start and become more and more dilute to the northward till it is hard to say where they really end. Their northward boundaries, therefore, must be drawn arbitrarily or must be based upon the presence or absence of particular species rather than the usual association of species. Counting from the north, the Carolinian area is that in which the sassafras, tulip tree, hackberry, sycamore, sweet gum, rose magnolia, red bud, persimmon and short-leaf pine first make their appearance, together with the opossum, gray fox, fox squirrel, cardinal bird, Carolina wren, tufted tit, gnatcatcher, summer tanager and yellow-breasted chat."

The western part of the upper Austral (Upper Sonoran) is the arid land termination of the Carolinian area. Its eastern boundary passes almost directly north and south through the center of South Dakota, Nebraska and Kansas. The Lower Austral (Austroriparian) occupies the greater part of the Southern States, sending up prolongations into southeastern Missouri, southern Illinois and Indiana, and southeastern Kansas. Its characteristic birds are the mockingbird, painted bunting, prothonotary warbler, red-cockaded woodpecker, chuck-will's-widow, and the swallow-tail and Mississippi kites.

"Investigations conducted by the Biological Survey have shown that *the northward distribution of terrestrial animals and plants is governed by the sum of the positive temperatures for the entire season of growth and reproduction*, and that *the southward distribution is governed by the mean temperature of a brief period during the hottest part of the year*. Transition zone species . . . can not endure a summer temperature the mean of which for the six hottest consecutive weeks exceeds 22° C. (71.6 F.), therefore its southern boundary is coincident with the isotherm of 22° C. for the six hottest weeks . . . the southern boundary of the Upper Austral zone agrees very closely with the isotherm of 26° C. (78.8 F.) for the six hottest weeks."

The geographical position of the State of Iowa, near the center of the United States, and of the great Mississippi Valley, causes its bird fauna to be rich in number of species, and its life zones difficult to map definitely. Its cold winters bring many Boreal visitors from the north, and the hot summer attracts many species which are distinctly southern. Thus the Mockingbird, a typical Lower Austral form, frequently reaches southern Iowa, the Prothonotary Warbler follows the Mississippi bottoms for some distance past the Minnesota line[1] and has been taken in the Des Moines River valley as far north as Algona. Iowa is also near the border line where the eastern varieties of many common birds begin to shade off into the western forms. The occurrence of the Burrowing Owl and Lark Bunting on the prairies of northwestern Iowa is indicative of a close connection with the typical fauna of the Great Plains. Reports from a number of observers indicate that the Cardinal Grosbeak has extended its range considerably to the northward in Iowa during the past few years, while proofs are not lacking that numerous woodland birds have become common in northwestern Iowa within the past twenty years, during which time that part of the state has been rapidly settled, and its surface modified by the planting of groves. The Cape May Warbler is believed to have extended its common range well westward into Iowa within the past twenty-five years, while the Western Meadowlark has in the same time spread over nearly the entire eastern part of the state.

The intermediate character of the Iowa bird fauna may be indicated by a comparison between two recent standard field textbooks on the birds of the eastern and western United States respectively:

Chapman's Handbook of the Birds of Eastern North America[2] omits the following twenty-one species, all of which have been taken in Iowa: Western and American Eared Grebes, Harris Hawk, Western Redtail, Mexican Goshawk, Richardson Merlin, Burrowing Owl, Northern Hairy Woodpecker, Western Nighthawk, Sennett Nighthawk, Magpie, Clarke Nutcracker, Gray-

1. Roberts, Auk, xvi, 1899, pp. 236-246.

2. Handbook of Birds of Eastern North America, with keys to the species and descriptions of their plumage, nests and eggs, their distribution and migrations and a brief account of their haunts and habits, with introductory chapters on the study of ornithology, etc., by Frank M. Chapman, Assistant Curator of the Department of Mammalogy and Ornithology in the American Museum of Natural History, New York City, etc. New York. 1903.

crowned Leucosticte, Western Grasshopper Sparrow, Baird Sparrow, Harris Sparrow, Gambel Sparrow, Sprague Pipit, Rock Wren, Long-billed Chickadee, Chestnut-backed Bluebird, and mentions as stragglers into this region, but does not describe, the Red-shafted Flicker, Arkansas Kingbird, Say Phœbe, Brewer Blackbird, Chestnut-collared Longspur, McCown Longspur, Montana Junco (as *shufeldti*), and Lark Bunting.

Bailey's Handbook of the Birds of the Western United States[1] omits about twenty-eight Iowa species: Brünnich Murre, Black Duck, American Eider, King Eider, Blue Goose, King Rail, Purple Gallinule, Harlan Hawk, Yellow-bellied and Green-crested Flycatchers, Philadelphia Vireo, Yellow-throated Vireo, Prothonotary, Worm-eating, Blue-winged, Golden-winged, Cape May, Bay-breasted, Sycamore, Pine, and Prairie Warblers, Louisiana Water-thrush, Kentucky Warbler, Mourning Warbler, Yellow-breasted Chat, Hooded Warbler, Tufted Titmouse, and Carolina Chickadee. It also lists only the western varieties of the following: Brown Pelican, Willet, Piping Plover, Ruffed Grouse, Red-shouldered Hawk, Great Horned Owl, Hairy Woodpecker, Downy Woodpecker, Hoyt Horned Lark, Meadow Lark, Evening Grosbeak, Vesper, Savanna, Grasshopper, Henslow, Field, and Tree Sparrows, Nashville Warbler, Mockingbird, Bewick Wren, Brown Creeper, Wilson and Hermit Thrushes.

CONTRIBUTORS.

The following persons have kindly furnished me with more or less extended notes, or lists of the birds of the counties under which their names are found. While many counties are unrepresented, most parts of the state are fairly covered, with no very extensive gaps. Without the ready and willing coöperation of these local observers the range of the various species would have been much less accurately determined:

Allamakee. Dr. B. H. Bailey of Cedar Rapids allowed me to examine a series of specimens in the Coe College museum, collected in the summer of 1904, mostly near Lansing.

Blackhawk. Prof. Morton R. Peck, Department of Biology,

1. Handbook of Birds of the Western United States, including the Great Plains, Great Basin, Pacific Slope, and Lower Rio Grande Valley, by Florence Merriam Bailey, with thirty-three full-page plates by Louis Agassiz Fuertes, and over six hundred cuts in the text. Cambridge. 1902.

Ellsworth College, Iowa Falls, lists 233 species, from both his father's observations and his own, covering a period of rather more than thirty years (Laporte City); Prof. G. W. Walters, Iowa State Normal School, 165 species, observed from 1895 to 1904 (Cedar Falls); Charles K. Salisbury, 161 species, restricted to Lincoln township (near Reinbeck).

Boone. Carl Fritz Henning gives 185 species in an annotated list published in the *Boone Daily News*, Feb. 20, 1904, (Boone).

Cass. Frank C. Pellett of Salem, Mo., lists 85 species, found in vicinity of Atlantic.

Cerro Gordo. Dr. F. G. Richardson of Mason City gives notes on a number of species observed at Clear Lake and other places.

Dallas. J. Eugene Law of Pomona, Cal., has given me many notes from the vicinity of Perry.

Delaware. Mrs. Mary L. Rann, assisted by Mrs. M. A. Triem, lists 150 species (Manchester).

Des Moines. Samuel B. Matson lists 96 species (Mediapolis).

Dickinson. Notes by George H. Berry, Charles K. Salisbury, W. H. Bingaman, and R. M. Anderson, mostly from Spirit Lake and the Okoboji lakes.

Franklin. Frank H. Shoemaker lists 150 species in a list of the birds of Franklin county, 1896 (Hampton).

Grundy. W. H. Bingaman, of Algona, a former resident of Grundy county, gives a few notes.

Hancock. M. Earl Halvorsen, Dr. B. H. Bailey and R. M. Anderson furnished many notes.

Hardin. Prof. Morton E. Peck and M. Earl Halvorsen give a few notes from Iowa Falls.

Henry. David L. Savage of Salem gives many notes. Walter G. Savage gives a few notes with his Van Buren county list.

Howard. E. B. Webster of Cresco sends a few notes.

Jackson. H. J. Giddings lists 215 species from the most eastern station in the state (Sabula).

Jasper. Joseph C. Sloanaker (Newton) and J. W. Preston (Baxter) give a few notes.

Johnson. R. M. Anderson lists 215 species, from several years' observations, supplemented by records of specimens in the collections of the Museum of Natural History of the State University of Iowa (Iowa City).

Kossuth. W. H. Bingaman lists 157 species, with some particularly valuable notes on the water birds (Algona).

Lee. Edmonde S. Currier of Tacoma, Wash., lists 238 species observed in Lee county from 1888 to 1903; William G. Praeger of the University of Chicago lists 262 species observed in "the Keokuk district" (Lee county, Iowa), including some observed across the Mississippi (Hancock county, Ill.), and across the Des Moines River (Clark county, Mo.).

Linn. Prof. B. H. Bailey, M. D., of Coe College, lists 186 species (Cedar Rapids); Prof. Charles R. Keyes of Cornell College lists 152 species (Mt. Vernon); George H. Berry lists 266 species (Cedar Rapids).

Mills. Isador S. Trostler, M. D., of Niobrara, Neb. (formerly of Omaha, Neb.), lists 227 species from Mills and Pottawattamie counties.

Polk. A. I. Johnson lists 147 species, observed since 1890 (Des Moines).

Pottawattamie. Isador S. Trostler, M. D., lists 227 species from Pottawattamie and Mills counties, the records from the two counties being separated.

Poweshiek. Prof. Lynds Jones of Oberlin, Ohio, furnishes a transcript of Carl Kelsey's "Birds of Poweshiek County" (O. & O., xvi, 9, 1891, pp. 131-34), with corrections and emendations to the same, listing 230 species (Grinnell). Joseph C. Sloanaker gives a few notes from Grinnell.

Scott. Burtis H. Wilson of Rock Island, Ill., lists 168 species observed from 1884 to 1894, on Iowa side of Mississippi River, principally around Davenport. He adds 24 species from Rock Island Arsenal, and the Illinois side of the Mississippi, opposite Iowa.

Sioux. A. I. Johnson of Des Moines lists 91 species observed in 1890-1891 in the vicinity of Hull. George H. Berry of Cedar Rapids reports 21 species noted at Hawarden during the last week of May and first week of June, 1890.

Van Buren. Walter G. Savage of Monteer, Mo., lists 232 species, mostly from the vicinity of Hillsboro.

Warren. Arthur A. Jeffrey lists 134 species (Indianola). He notes that water birds are not nearly so numerous as they were in Page county, where he lived previous to 1893.

Wayne. Albert J. Brown. A list of 127 species was obtained from him by Dr. Frank A. Stromsten of the University of Iowa (Melrose).

Webster. Melvin P. Somes lists 152 species (Fort Dodge).

Winnebago. R. M. Anderson lists 222 species, mostly observed around Forest City, on the line between Winnebago and Hancock counties. J. Eugene Law of Pomona, Cal., and M. Earl Halvorsen of Forest City, both of whom collected with the writer for several years in that locality, also furnished many notes.

Winneshiek. Carsten C. Smith, M.D., lists 185 species from his own notes and from those of Hall Thomas of Decorah. He attributes the scarcity of water birds in this portion of the "driftless" area to the absence of lakes or extensive marshes (Decorah).

Woodbury. Guy C. Rich, M. D., lists 210 species from a territory included within a 25-mile circle of Sioux City. "This, of course, includes some of Nebraska and South Dakota, but birds found that close to our border may be reasonably expected across a border line, often only marked by a small river or an imaginary line."

Several counties, from which I received no notes personally, have been well covered, in certain groups, at least, by the observations of then resident ornithologists, whose systematic compilations were published in *The Iowa Ornithologist* a few years ago. Among such may be mentioned: *Buena Vista* (John V. Crone); *Fayette* (Paul C. Woods); *Lyon* (Carleton R. Ball); *Mahaska* (Wm. Alanson Bryan); *Marshall* (A. P. Godley); *Scott* (J. H. Brown); *Sioux* (Wilmon Newell); *Story* (Carleton R. Ball, Wm. A. Bryan, and Wilmon Newell). Indebtedness must also be acknowledged to Wm. Alanson Bryan, curator of the Bernice Pauahi Bishop Museum, Honolulu, author of "Birds of Hawaii," and to Wilmon Newell, State Entomologist of Georgia, Atlanta, for helpful suggestions.

THE BIRDS OF IOWA.

Class AVES.

Subclass CARINATÆ. Birds with keeled sternum.

Order PYGOPODES. The Diving Birds.

Suborder PODICIPIDES. Grebes.

Family PODICIPIDÆ. Grebes.

The Grebes are usually classed as having the lowest type of organization and structure among birds. They are the most eminently aquatic of birds, possessing marvelous powers of diving. The short legs, placed at the posterior extremity of the body, make their movements on land very awkward, and they rarely leave the water. Grebes feed largely on fish, which are pursued and caught under water.

Genus ÆCHMOPHORUS Lawrence.

1. (1).* *Æchmophorus occidentalis* (Lawrence). Western Grebe.

This large Western species was reported from Iowa by two observers. "Two or three accidental specimens noted in Blackhawk county in early spring. Recorded by my father, George D. Peck, the last time about seventeen years ago. The specimens were not taken, but his familiarity with Iowa birds is such that I think the record trustworthy." (Morton E. Peck.) Dr. Trostler reports it as a rare migrant in Pottawattamie and Mills. The species has been taken twice at Lake Koshkonong, Wis. (Kumlien and Hollister); reported twice from Nebraska, once from Cutoff Lake, near Omaha (Rev. Bds. Neb., p. 16), twice from Minnesota: Red River and Big Stone Lake (Hatch). Rev. P. B. Peabody found two nests at Heron Lake, Minn., June 2, 1894 (Oölogist, xii, i, 1895, 15). From the last record it appears probable that it may rarely occur in summer in western Iowa.

Genus COLYMBUS Linnæus.

2. (2). *Colymbus holbœlli* (Reinh.). Holbœll Grebe.

This species appears to be very rare in Iowa. It was listed by J. A. Allen (White's Geol. of Iowa, 1870), and reported from

*The numbers at the left are the Iowa numbers and those in parenthesis are the A. O. U. numbers of the species.

Linn county as a "rare winter visitant" (G. H. Berry). Kumlien and Hollister report it as occurring sparingly as a migrant in Wisconsin, remaining all winter where there is open water. It has also been reported from Minnesota, once from Fillmore county, near the Iowa line (Hatch).

3. (3). *Colymbus auritus* Linn. Horned Grebe.

The Horned Grebe was given as a rather common migrant in Iowa by Keyes and Williams, but it appears from the reports of observers to be generally rare at present. The earliest record is that of Thomas Say, "Colymbus cornutus. Arrived May 5, 1820, Engineers' Cantonment" (Long's Exp. to Rocky Mts. 1, 266). Dr. B. H. Bailey has three specimens taken in a slough near Cedar Rapids, showing three distinct phases of plumage: April 19, 1903, male, full plumage; April 19, 1903, plumage changing, head and neck mottled; Nov. 11, 1902, female, winter plumage. The Horned Grebe was reported by Dr. Hvoslef as breeding in the vicinity of Lanesboro, Fillmore county, near the southern border of the state (Hatch, Bds. of Minn. 1892, p. 6).

County records: Blackhawk—"occasional summer visitant, nesting; specimen mounted by myself in I. S. N. S. Museum" (Walters); "rare transient" (Salisbury). Cerro Gordo—"one specimen April 6, 1890" (Richardson). Des Moines—(Bartsch). Jackson—"common transient" (Giddings). Keokuk district—"rare transient" (Praeger). Linn—(Bailey, Berry). Poweshiek—"rare transient" (Kelsey, Jones).

4. (4). *Colymbus nigricollis californicus* (Heerm.). American Eared Grebe.

This species appears to be somewhat locally and irregularly distributed in Iowa, although common at certain points. "It has been found breeding in small numbers at West Point and Omaha" (Rev. Bds. Neb., p. 17).

County records: Hancock—Dr. B. H. Bailey found this species quite common at Eagle Lake, in July, 1902. They were more common than the Pied-billed Grebe. Three adult specimens were shot there July 18-19, 1902, and many were seen leading their young. He says: "I took eggs and also photographed and shot birds in June, 1903." Pottawattamie—Mills—"com-

mon migrant" (Trostler). Woodbury—Dr. Rich reports a specimen taken at Sioux City (West. Orn. v, 1, 1900, p. 24). Linn—"tolerably common migrant" (Berry).

Genus PODILYMBUS Lesson.

5. (6). *Podilymbus podiceps* (Linn.). Pied-billed Grebe.

This familiar little Grebe is by all means the most common representative of the order in Iowa. It is reported by all observers as common on all lakes, ponds and streams of the state during the spring and fall, and is found nesting in almost any locality where a marsh, pond or slough is to be found in summer. Most gunners are familiar with its adeptness in diving, which has gained for it the almost universal name of "Hell-diver." The nest is a floating mass of wet, decaying vegetation, in a pond or marsh, usually situated where the grass leaves patches of open water. The old bird is very seldom seen near the nest, and the eggs are almost invariably buried in the wet, rotten, nest material. The eggs are six to nine in number, pale blue when first laid, but rapidly becoming stained a dirty brown. In Winnebago county eggs are laid about June 1. However, on June 4, 1897, I saw a Grebe followed by downy young, and the same day took a set of slightly incubated eggs. C. F. Henning records a set of nine eggs May 20, 1897 (Boone); and John V. Crone a set of six May 23, 1891, in Palo Alto (Iowa Orn., i, 2, 1895, pp. 44–45).

The writer kept two specimens alive for several days at the Science Building of the University. When placed on the floor they progressed by a series of hops, with breast resting on the floor, or raising the body suddenly, running on the toes, flapping the wings at the same time. They appeared unable to fly up from the floor. In swimming and diving the grebes paddled alternately with the legs, the lobate webs on each side of the toes folding together during the forward stroke and opening out with the backward stroke. In dressing the plumage the bird would lie on one side, with one foot out of water, and paddle around in a circle with the other foot. A young bird in the down, which I once caught, appeared very tame, and when replaced in the water made frantic efforts to overtake the boat, "*peeping*" like a lost chick.

Suborder CEPPHI. Loons, Auks, Murres, etc.

Family GAVIIDÆ. Loons.

Three species of this family are found in Iowa, but only one is at all common. The Loons are similar to the Grebes in structure and habits, but are considerably larger birds.

Genus GAVIA Forster.

6. (7). *Gavia imber* (Gunn). Loon.

The Loon is reported as common during the migrations in nearly all parts of the state, though a few observers report it as a rare transient. The spring migration is usually in April and the fall migration in November.

The Loon appears to be a summer resident only in the northern part of the state. Prof. Walters reports the Loon as an "occasional summer visitant" in Blackhawk county. Dr. B. H. Bailey observed them on Clear Lake (Cerro Gordo) July 7 to 14, and on Eagle Lake (Hancock) July 19, 1902. At Rice Lake (Winnebago) J. Eugene Law took a set of eggs from the top of an old muskrat house about the last of May or first of June, 1893, and M. Earl Halvorsen has observed the species in summer at the same place. The writer saw three and shot one at Rice Lake June 1, 1895, and saw one specimen on Swan Lake, near Lake Mills (Winnebago), May 30, 1895: also mounted one shot on Silver Lake (Worth) June 1, 1897. April 21, 1905, I caught a Loon alive within the limits of Iowa City, the morning after a severe thunder-storm. It seemed to be unable to fly up from the ground, although apparently uninjured. When approached, it made frantic efforts to escape, fluttering and dashing along the ground for several rods at a time. The voice of the Loon has something weird and mysterious about it when heard at night on a quiet lake, sometimes resembling a peal of maniacal chuckles or laughter.

7. (9). *Gavia arctica* (Linn.). Black-throated Loon.

The Black-throated Loon is a northern species which very casually visits Iowa. Two specimens have been taken in Jackson county. J. Giddings reports (Iowa Orn., ii, 4, 1896, 73): "Nov. 15, 1895, a male Black-throated Loon was shot while swimming in the Mississippi River a little way from the shore opposite

Sabula, by Mr. W. Eldridge. Identified by Dr. C. Hart Merriam." H. J. Giddings reports (West. Orn., v, 3, 1900, 60): "On Nov. 26, 1899, an immature male was shot on the Mississippi River at this place [Sabula] and sent to me for mounting." A specimen in the University Museum, No. 10175, in juvenile plumage, was taken at Burlington; recorded by Prof. C. C. Nutting (Proc. Iowa Acad. Sci., 1894, 44).

8. (10). *Gavia lumme* (Gunn). Red-throated Loon.

Like the preceding species, the Red-throated Loon is rare in Iowa. It is listed by J. A. Allen (White's Geol. of Iowa, 1870). Kumlien and Hollister give the species as "a regular and common resident on Lake Michigan in winter. . . . On the larger inland lakes and ponds and streams it is seldom seen in spring, but occurs sparingly in October and November, or until the ice forms" (Bds. of Wis., 1903, 7). There are two Nebraska records, both males, taken on the Missouri near Omaha, one Sept. 28, 1894, another April 6, 1897, reported by I. S. Trostler (Rev. Bds. Neb., 1904, 7).

County records: Blackhawk — "rare winter or fall visitor" (Peck). Franklin—"three years ago saw a flock on a small lake in Franklin county and secured two at one shot" ("Sea Birds that Visit Iowa," Iowa Orn., ii, 2, 1896, 32). Jackson—"very rare" (H. J. Giddings). Polk—"I mounted one which must have been a straggler. Although the party who shot it said there were others, he might have been mistaken" (Johnson).

Family ALCIDÆ. Auks.

The Auks are without exception maritime birds, confined to the northern parts of the northern hemisphere. The occurrence of any of the species in Iowa must be regarded as accidental.

Subfamily ALCINÆ. Auks.

Genus URIA Brisson.

9. (31). *Uria lomvia* (Linn.). Brünnich Murre.

Dr. Elliott Coues (Key to North American Birds, 5th Ed., Vol. II, p. 1084) says: "Individuals of any species are liable to be blown inland or otherwise beyond their range. Thus, a storm of

Dec. 16, 1896, scattered a flight of Brünnich's Murres over the U. S. from Michigan and Indiana to South Carolina; a few of these were captured and recorded (Auk, Apr., 1897, pp. 197-199, 202, 203, 226, 228)." Frank C. Pellett reports "a lost specimen, caught alive in December" (Cass). J. H. Brown ("An Accidental Visitor," Iowa Orn., iii, 1, 1897, 11) says: "Mr. Frank Pellett of Atlantic sends me a description of what will prove to be one of the Murres, probably the Atlantic form, *Uria troile* Linn. It was captured alive, but thoroughly exhausted, Dec. 20th, near Atlantic, and died some time after. It has been mounted and is now in Mr. Pellett's collection." Mr. George C. Hoover of West Branch wrote to me under date of April 4, 1897: "I had given to me perhaps one of the most rare and strange birds ever found in the state. It was a specimen of the Auk family known as the Murre (*Uria troile*). It was found in Johnson county in January of this year. I mounted it and now have it in my collection."

Both of these specimens were undoubtedly stragglers from the great flight of Brünnich Murres recorded above.

Order LONGIPENNES. The Long-winged Swimmers.

Family STERCORARIIDÆ. Jægers, or Skuas.

The Jægers are inhabitants of northern regions, usually pelagic, and only occasionally appearing inland. They are rapacious and generally subsist by robbing Gulls and Terns.

Genus STERCORARIUS.

10. (37). *Stercorarius parasiticus* (Linn.). Parasitic Jæger.

One specimen is reported from Lee county by Mr. William G. Praeger: "Accidental, one record; shot on the Mississippi opposite Keokuk and brought to me Oct. 6, 1896." Edmonde S. Currier says of this specimen: "It was shot on the Des Moines Rapids of the Mississippi at Keokuk, Oct. 6, 1896. I saw the skin in Mr. Praeger's collection and think that it was properly identified. The locality is correctly Iowan." In the Coe College collection Dr. B. H. Bailey has a specimen shot Sept. 20, 1905, at Eagle Lake, near Britt, Hancock county, by James Ward. Length, 18 inches; extent of wing, 41½ inches; iris hazel. Sex, female (?), doubtful, on account of the specimen being badly shot.

Family LARIDÆ. Gulls and Terns.

The Gulls and Terns are birds of strong flight, graceful on the wing, and usually found over water. Their food consists chiefly of fish, either caught alive or found dead, and garbage found in the water. In general the Gulls are larger than the Terns, with thicker, more strongly hooked bill. In flight the Gulls usually hold the bill horizontally, in line with the body, while the Terns fly with the bill pointing downward instead of forward. Most of the Terns, as well as the Gulls, are valuable as insect destroyers, particularly of the larvæ of water-breeding insects.

Subfamily LARINÆ. Gulls.

Genus LARUS Linnæus.

11. (51). *Larus argentatus* Brünn. Herring Gull.

The Herring Gull appears to be fairly common as a migrant along the larger rivers of the state, being most numerous along the Mississippi. Currier and Praeger report it as a "common winter resident; abundant migrant" in Lee county. All other observers report it simply as a migrant. The University museum has specimens collected on the following dates: March 29, 1887, by Jacob Ham; March 12, 1898, by Wm. Mathes (Johnson); Sept. 15, 1890, by Paul Bartsch (Des Moines county); March 21, 1904, by P. G. Bayers (Marengo, Iowa county); male in Bond collection, Greencastle (no date).

County records: Blackhawk—(Peck, Walters); Des Moines—(Bartsch); Dickinson—(Berry); Iowa—(Bayers); Jackson—(Giddings); Lee—(Currier, Praeger); Polk—(Johnson); Woodbury—(Rich). "Common transient on Mississippi River near Rock Island, Ill." (Wilson).

12. (54). *Larus delawarensis* Ord. Ring-billed Gull.

The Ring-billed Gull is probably the most common representative of the genus in Iowa. There is no evidence of its nesting in Iowa, although many observers report it to be generally common as a migrant.

County records: Blackhawk—(Peck); Boone—(Henning); Dickinson—(Berry); Hancock—"one shot from a flock of three on Lake Edwards, May 13, 1893" (Anderson); Jasper—Powe-

shiek—(H. W. Parker, Am. Nat., v, 1871, 169); Johnson—(Anderson); Lee—(Currier, Praeger); Linn—(Bailey, Berry); Jackson—(Giddings); Mills—Pottawattamie—(Trostler); Sioux—(Johnson); Woodbury—(Rich).

13. (58). *Larus atricilla* Linn. Laughing Gull.

This gull is a southern species, rarely found as far north as Iowa, in the interior. Thomas Say (Long's Exp., i, pp. 266-70), notes "*Larus ridibundus*. Large flocks flying northward May 20, 1820." (Engineers' Cantonment). The species has been reported from Omaha by L. Skow (Rev. Bds. Neb., 20). Dr. Trostler reported the Laughing Gull as a "scarce migrant in Pottawattamie and Mills counties. I have seen them frequently at Big Lake and Manawa Lake (Pottawattamie), and along the river in Mills county. One killed Oct. 10, 1894, at Blencoe, Iowa, by H. W. Kerr (reported to me by J. A. Dickinson, of Gresham, Neb.)."

14. (59). *Larus franklini* Sw. and Rich. Franklin Gull.

The Franklin Gull is an inhabitant of the inland waters, and has not been recorded from either coast. It appears to be a frequent migrant in Iowa, according to nearly all observers, but it is doubtful whether it breeds in Iowa at the present time. Col. N. S. Goss (Bds. of Kan., 26) states: "They have been found breeding as far south as northern Iowa. . . . one set of three eggs taken May 20, 1885, by Mr. J. W. Preston, on Marsh Lake, Minn." Keyes and Williams state that "Mr. J. W. Preston found the species breeding at Heron Lake, Minn., a few miles from the northern boundary of Iowa." Rev. P. B. Peabody ("Water Birds of Heron Lake." Oöl. xii., 1, 1895, 16) says that "Though the Franklin Gulls were present by the hundred all summer long, increasing greatly in numbers during the autumn, not a nest was found." G. H. Berry reports that the species was an abundant summer resident at Spirit Lake in 1892 and 1893.

County records: Cerro Gordo—"several killed at Clear Lake in October, 1893; occasional summer visitor" (Richardson). Des Moines—Aug. 3, 1892, Burlington (Bartsch). Hancock—"Crystal Lake" (Halvorsen) "saw four or five Oct. 16, 1894" (Anderson). Kossuth—"transient" (Bingaman). Lee—"common

migrant" (Currier and Praeger). Linn—(Bailey). Pottawattamie —Mills—"common migrant" (Trostler). Poweshiek—"rare transient" (Kelsey). Webster—"frequent migrant" (Somes). Woodbury—"uncommon transient" (Rich); a female specimen in the University museum, taken at Sioux City, May 6" (Anderson).

15. (60). *Larus philadelphia* (Ord). Bonaparte Gull.

The Bonaparte Gull is one of the most widely dispersed species in North America. Breeding chiefly in high latitudes, it only reaches Iowa during the migrations. It is not usually as common as the Franklin Gull. Dr. B. H. Bailey has a female specimen taken April 30, 1902, on a slough near Cedar Rapids. Dr. Trostler gives it as a common migrant in Pottawattamie and Mills, seen in very large flocks in autumn and smaller flocks in spring. Recorded from Linn as a "rare migrant" (Bailey); Jackson—"tolerably common transient" (Giddings); Kossuth—"transient" (Bingaman).

Genus XEMA Leach.

16. (62). *Xema sabinii* (Sab.). Sabine Gull.

Only two specimens of this species have been recorded as captured in Iowa. Dr. Paul Bartsch (Auk, xvi, 1899, 86), says: "My collection of Iowa birds contains two immature specimens of Sabine's Gull, both of which were taken on the sandbar immediately above Burlington, Iowa. No. 50 (S. U. I. No. 15981) male, was shot Oct. 15, 1891; No. 51 (S. U. I. No. 15982) female, Oct. 12, 1894. These I believe are the first records of this species for Iowa. The specimens are deposited at the State University at Iowa City."

Subfamily STERNINÆ. Terns.

Genus STERNA Linnæus.

Subgenus THALASSEUS Boie.

17. (64). *Sterna caspia* Pallas. Caspian Tern.

The Caspian Tern appears to be a tolerably common but somewhat irregular migrant in Iowa, frequently appearing in considerable numbers. The species was listed by Allen (1870), and Cooke (Bird Migr. in Miss. Val, 1884–5, 57,) states that Mr. J. W. Preston has taken it in central Iowa. Prof. C. C. Nutting

records a specimen in the University museum, taken in Johnson county (Proc. Iowa Acad. Sci., 1892, 40). Dr. B. H. Bailey has specimens taken at Cedar Rapids March 10, 1903, Sept. 11 and 28, 1903. He states that during September, 1903, large numbers were flying over Cedar Rapids in scattered flocks, and several other specimens were taken, both in adult and juvenile plumage.

Wm. E. Praeger states that it is "a regular fall migrant but never recorded in the spring. Small flocks frequently stay for days on some favorite sandbar, earliest date Sept. 9, latest Oct. 15" (Keokuk district). G. H. Berry reports it as a "tolerably common migrant" (Linn); and B. H. Wilson as a "straggler; one record, near Rock Island, Ill."

The University museum has several specimens: No. 3689, female, Johnson county, Sept. 16, 1889, E. R. Griffin; 16267, Burlington, Sept. 17, 1898, Paul Bartsch; 10581, male, Oct. 3, 1894, Johnson county, D. L. Gorton; 3923, Iowa, no date; 15983, Sept. 25, 1895, Henderson county, Ill. (oppposite Burlington), Paul Bartsch.

Subgenus STERNA Nuttall.

18. (69). *Sterna forsteri* Nutt. Forster Tern.

This species is a tolerably common migrant over most of the state, and a few are found throughout the summer on various lakes of northern Iowa. I have found no authentic records of the Forster Tern nesting in Iowa, although Rev. P. B. Peabody found a small colony nesting at Heron Lake, Minn., on muskrat houses, May 26 and June 10, 1894 (Osprey, i, 1, 1896, 1-3, "A Tern Study").

County records: Boone—"arrives about last week in April, becomes quite common during spring and fall migrations; small flocks of ten or twelve may often be seen at the large ponds where they remain for several weeks" (Henning). Cerro Gordo—"common summer resident. I have a male taken at Clear Lake, June 10, 1891" (Richardson). Clinton—(Parker, Am. Nat. v, 1871, 169). Dickinson—"abundant summer resident; Spirit Lake" (Berry); "several shot at Spirit Lake the last week in July, 1902" (Bailey); "common on West Okoboji Lake, Aug. 13-19, 1901" (Anderson). Franklin—"frequent migrant" (Shoemaker). Hancock—"migrant" (Anderson). Jackson—"com-

mon transient" (Giddings). Johnson—"specimen in University Museum shot May 5, 1888, Iowa City, by C. Houseworth" (Anderson). Kossuth—"rare transient" (Bingaman). Lee—"common migrant" (Currier, Praeger). Linn—"shot one May 21, 1904, Cedar Rapids" (Bailey). Pottawattamie — Mills — "abundant migrant" (Trostler). Poweshiek—"rare transient" (Kelsey). Sioux—"common" (Johnson). Winnebago—"frequent migrant" (Anderson). Winneshiek—"rare visitant; reported by Hall Thomas" (Smith). Woodbury—"uncommon transient" (Rich). The species was observed at Bear Lake, Minn., May 27, 1896, just across the state line from Winnebago county, by J. Eugene Law.

19. (70). *Sterna hirundo* Linn. Common Tern.

This species appears to be less common in Iowa than the preceding. The earliest Iowa record is that of Prince Maximilian (Reise in das Innere N. A., ii, 341), above Boyer's Creek, near Council Bluffs, May 12, 1834. He says: "Ein Flug der rothschnäbligen Meerschwalbe (*Sterna hirundo*) strich über uns weg, wovon wir eine erlegten." Allen lists it (1870), and Cooke states that it was taken by Mr. Preston in central Iowa (Bird Migr. in Miss. Val., 1884–5). Prof. Nutting reports a specimen from Johnson county in the University museum (Proc. Iowa Acad. Sci., 1892, 40).

County records: Blackhawk—"common transient" (Salisbury). Des Moines—two specimens in the University museum were taken at Burlington, May 26, 1893, by Paul Bartsch. Linn—"rare" (Berry). Pottawattamie—Mills—"abundant migrant" (Trostler); Poweshiek—"transient" (Kelsey, Jones).

20. (74). *Sterna antillarum* (Less.). Least Tern.

This dainty little Tern does not appear to be common in Iowa at any time. Thomas Say records the arrival of the Lesser Tern (*Sterna minuta*) at Engineers' Cantonment April 2, 1820 (Long's Exp., i, 216). John Krider (Forty Years' Notes, 1879, p. 82), says: "I found it very plenty on Clear Lake, Iowa. Breeds on the drift along the shore of the lake." "L. Skow found it breeding at Cut-off Lake, near Omaha, in 1893. Numerous migration records from Omaha," etc. (Rev. Bds. Neb., 21.)

County records: Lee—"I find I have never seen it, but specimens locally obtained are in local collections, with no data. Currier has seen them on June 20, 1888, on bars of Des Moines, acting as if they were nesting" (Praeger). Linn—"rare migrant" (Berry). Polk—"rare" (Johnson). Pottawattamie—"scarce migrant" (Trostler). Sioux—"rare" (Johnson). Winnebago—"several seen in company with Black Terns at Rice Lake, June 1, 1895; one shot" (Anderson).

Genus HYDROCHELIDON Boie.

21. (77). *Hydrochelidon nigra surinamensis* (Gmel.). Black Tern.

The Black Tern, usually known in Iowa as the "Slough Gull," is an abundant migrant over all sections of the state, nesting commonly in suitable localities in the northern half of the state. The writer has observed only a few specimens in Johnson county, in the month of May, but in Winnebago and Hancock has observed them abundantly from the early part of May until September. In early spring hundreds may sometimes be seen at one time, and if one is shot the others will hover over their fallen comrade in the water. Later in the season they are not generally seen in such large flocks, being scattered around in different sloughs, nesting. In some sloughs only one pair may be found, while others have from ten to fifty pairs. The Black Tern seems to prefer grassy and reedy marshes, in which the nest, an almost flat mass of grass, reeds, moss and mud is placed, raised a little above the surface of the water, and often floating. The eggs are two or three in number, varying remarkably in size, shape, and coloration, no two sets being alike; but all eggs from the same set have a close similarity. In this locality the Black Tern rears two broods in a season, the first set being deposited in the latter part of May or first of June, and the second set in July. In only one instance have I found a nest that was not placed over water—this was simply a few weeds arranged in a circular form on a piece of low ground quite a little distance from the water.

Dr. J. A. Allen records "great numbers, July 20, about Wall Lake, in Sac county. The young had already flown and were accompanying the parents" (Mem. Bost. Soc., i, 1868, 502). In Decatur and Mahaska, T. M. Trippe observed them "about pools of water on the prairies in May only" (Proc. Bost. Soc., xv, 1872,

241). C. F. Henning found the Black Tern breeding in Hamilton county June 26, 1893 (West. Orn., v, 2, 1900, 87). Dr. C. C. Smith reports it "an irregular visitant, seen most commonly in the latter half of May. I have also seen it in June and July" (Winneshiek). W. A. Bingaman as "abundant; breeding" (Kossuth); F. H. Shoemaker as a "rare summer resident" (Franklin); Dr. I. S. Trostler as an "abundant migrant; rare summer resident" (Pottawattamie—Mills). All other observers report the species only as a migrant.

The Black Terns do not seem to be deterred from nest-building by proximity to houses and passing railway trains. They evince little fear of man and large numbers will often follow a man plowing, hovering over his head, and looking for grubs turned up by the plow. They are often killed with a whip at such times. Dr. Bailey observed hundreds of Black Terns at Eagle Lake, Hancock county, July 17–20, 1902, mostly feeding on crayfish. They have also been noted as feeding upon the nymphæ of the dragon-fly in large numbers. The food of the species in summer consists to a great extent of the larvæ of aquatic insects, small insects, small molluscs, etc., which are found upon the surface of the water.

Order STEGANOPODES. Totipalmate Swimmers.

Family ANHINGIDÆ. Darters.

The Western Continent has only one spieces representing this peculiar family. The Darter or Snake-bird is a common species in tropical and sub-tropical America and is casual or accidental north of southern Illinois.

Genus ANHINGA Brisson.

22. (118). *Anhinga anhinga* (Linn.). Anhinga. Snake-bird.

The only known record of the occurrence of this species in Iowa was given me by Walter G. Savage in a letter of Feb. 25, 1904. He says: "About twenty years ago one was killed in Henry county. This one is the only record that I have of any being in the state. I have no specimen; it was killed before I put up any, but I well remember the bird as being the Snakebird. It was killed on a little stream called 'Little Cedar,' in Henry county, Iowa, near Salem, and the man knew what a Cormorant was and

so did I. It is a positive fact that a Snakebird was killed in Iowa." Although reported by no other observers, Mr. Savage's long experience as a collector and observer of bird migrations makes this record appear an authentic one."

The species was reported in Bruner's list as a Nebraska bird on the authority of a specimen shot supposedly near Omaha, but it has since developed that the bird may have been secured either in Iowa or Missouri (Rev. Bds. Neb., 21–22).

Family PHALACROCORACIDÆ. Cormorants.

A single species of this family is found in Iowa. The Cormorants are large fish-eating birds, capturing their prey by pursuing it under water. They are gregarious at most seasons, but in Iowa, at least, are usually seen singly, in twos and threes, or straggling flocks, during migrations.

Genus PHALACROCORAX Brisson.

23. (120). *Phalacrocorax dilophus* (Sw. and Rich.). Double-crested Cormorant.

The Double-crested Cormorant is a regular and fairly common migrant over the whole of the state, being reported by nearly all the observers. In spring it appears from about the last week of March until the middle of April, and in fall from the latter part of September through October. B. H. Wilson reports fourteen seen Aug. 18, 1892; six seen Aug. 6, 1893 (Scott). W. W. Cooke states: "The Cormorant used to breed abundantly in a few places in northern Iowa, where Mr. Preston of Newton, Iowa, says he has taken a great many sets of eggs" (Bird. Migr. in Miss. Val., 1884–5, 59). Keyes and Williams (1889) also give the species as breeding in the northern part of the state. At the present time I am unable to find any records which show any recent nesting localities in the state.

Family PELECANIDÆ. Pelicans.

The Pelicans are large aquatic birds, feeding on fish which are scooped up in the large pouch below the lower mandibles. They are heavy-appearing birds, but swim lightly on the water owing to the large air-sacs beneath the skin.

Genus PELECANUS Linnæus.

24. (125). *Pelecanus erythrorhynchos* Gmel. American White Pelican.

The White Pelican is a rather rare but regular migrant across the state, quite large flocks being sometimes seen flying, or even alighting, in unexpected localities. It has not been known to nest in the state.

The earliest records appear to be those of Lewis and Clark (Hist. of L. and C. Exp., i, 70): "August 8, 1804—Two miles beyond this river (Little Sioux) is a long island which we called Pelican Island, from the numbers of that bird which were feeding on it; one of these being killed, we poured into his bag five gallons of water. . . . We camped on the north (in Monona county, Iowa). . . . Sept. 4, 1806 (Floyd's Bluff, below Sioux City). There is no game on the river except wild geese and pelicans." Thomas Say records the arrival of the Rough-billed Pelican (*P. erythrorhynchos*) at Engineers' Cantonment, April 8, 1820 (Long's Exp., i, 266–270). Prince Maximilian (Reise, i, 287) observed the flight of a flock of more than one hundred Pelicans, above the mouth of the Little Nemaha, on the right bank. John James Audubon (Journals, i, 484), on May 11, 1843, says: "We have seen several pelicans," etc. (below mouth of Little Sioux, Harrison county, Iowa); and "Oct. 3 (Little Sioux), several pelicans. . . . Oct. 6 (below Fort Croghan), killed two pelicans, but got only one."

Several specimens of the White Pelican are reported as killed every year, but the number seems to be decreasing in the state owing to the practice of hunters wantonly slaughtering any such rare or unusual bird which appears within gun-range. The majority of the spring records appear to come in April, but occasionally they come in March, and J. Eugene Law saw one on Bear Lake, Minn., just across the state line from Winnebago county, on May 27, 1896. In the fall they migrate from the middle of September until early October. One specimen in the University collection, No. 1412, was taken August 8, 1896, in Johnson county, by John Bauer; others, September 25, 1888 (Johnson); September 22, 1886 (Jonhson); October 1, 1902, (Johnson); September 28, 1902 (Iowa county).

25. (126). *Pelecanus occidentalis* (Linn.). Brown Pelican.

The Brown Pelican was first recorded from Iowa by Thomas Say (Long's Exp., i, 266), as *Pelecanus fuscus*, from Engineers' Cantonment. The only recent record which I find is that by Carl Fritz Henning ("A Southern Bird in Central Iowa," Annals of Iowa, v, 1, April, 1905, 62-3): "Last week a Brown Pelican (*Pelecanus fuscus*) was captured by the Fritcher brothers on the Des Moines River, about nine miles northwest of Boone. . . . . first seen swimming in a bayou." This bird was described in detail, also its habitat, in the *Boone Standard*, July 14, 1900.

Family FREGATIDÆ. Man-o'-war Birds.

The Man-o'-war or Frigate Bird is an almost strictly maritime, predaceous bird, with wonderful powers of flight. Only one species occurs in America, and is not uncommon on southern coasts. W. W. Cooke (Bird Migr. in Miss. Val., 1884–5, 60) reports two instances of its occurrence at a distance of eight hundred miles from the nearest salt water; one killed in Osborne county, Kansas, Aug. 16, 1880; and one killed a few miles north of Milwaukee, Wis., in August, 1880.

Genus FREGATA Cuvier.

26. (124). *Fregata aquila* (Linn.). Man-o'-war Bird.

The Man-o'-war Bird is only an accidental visitant in Iowa. Morton E. Peck (Iowa Orn., ii, 2, 1896, 34) reports the occurrence of a specimen at LaPorte, Iowa (Blackhawk county), and Dr. Paul Bartsch told me of a specimen taken near Burlington, Iowa, by a gunner in the latter part of September, 1903, but as it was not known whether obtained on the Iowa or Illinois side of the Mississippi River, the latter may hardly be considered as an official Iowa record.

Order ANSERES. Lamellirostral Swimmers.

Family ANATIDÆ. Ducks, Geese, and Swans.

Subfamily MERGINÆ. Mergansers.

All of the three American species of this subfamily occur in Iowa. The Mergansers, known also as the Saw-bills, or Fish Ducks, are characterized by a narrow, nearly cylindrical bill, with

the lamellæ of the mandibles developed into prominent serrations. They feed principally upon fish, and their flesh is consequently somewhat rank and fishy, although the Hooded Merganser is usually accounted quite palatable.

Genus MERGANSER Brisson.

27. (129). *Merganser americanus* (Cass.). American Merganser.

The American Merganser is a fairly common migrant in Iowa, being reported by most observers. It is a cold weather bird, appearing early in the spring with the first open water, and late in the fall. Dr. F. G. Richardson notes that in Cerro Gordo county he has observed only one sex in a migrating flock, either all males or all females. The American Merganser has been found breeding in northern Iowa by Mr. Preston of Newton, Iowa, according to W. W. Cooke (Bird Migr. in Miss. Val., 1884–5, 60–61). There seems to be no recent nesting record, but Dr. C. C. Smith has seen them as late as May 16, in Winneshiek county. W. H. Bingaman reports the species as a "winter resident in Kossuth county; on open water along the Des Moines River, caused by springs. At these open holes this species is generally found; however, very wild. Three were shot at our annual rabbit hunt last winter. Saw two birds Dec. 30, 1905."

28. (130). *Merganser serrator* (Linn.). Red-breasted Merganser.

Most observers report the Red-breasted Merganser as a migrant, but rarer than the preceding species in Iowa. Three observers — Henning (Boone), Peck (Blackhawk), and Berry (Linn), report it as more common than the American Merganser. It usually migrates at the same time as that species, appearing just as the streams and lakes are opening up in the spring or at freezing time in the fall. The Red-breasted Merganser has not been known to nest in Iowa.

Genus LOPHODYTES Reichenbach.

29. (131). *Lophodytes cucullatus* (Linn.). Hooded Merganser.

This striking little Merganser is tolerably common throughout Iowa as a migrant, and still nests occasionally in the state. Like

the Wood Duck, the Hooded Merganser builds its nest in a hollow tree. Baird, Brewer and Ridgway (N. A. Birds. Water Birds, ii, 124) describe the eggs as pure ivory-white, and of a rounded oval, almost globular form, from a specimen in the Smithsonian Institution, collected in Iowa.

J. W. Preston says ("Notes on Bird Flight," O. & O., xvii, 3, March, 1892, 42): "While camping on Little Twin Lakes, northern Iowa, some years since, I noticed a male Hooded Merganser circling around a grove so often that it seemed certain that he was feeding his mate, which they do at incubating time. I concealed myself and watched for a long time, and finally was rewarded by seeing the fellow fly plump into a hollow in a gigantic oak. It would seem to be a piece of recklessness; certainly if he had not aimed well he would have suffered for the error. . . . I timed one of this species, and it made its mile in less than one minute."

Nearly all observers in the state regard the species as a migrant. A few other records are given:

Blackhawk—"this species formerly bred quite frequently in Blackhawk county, but no nest has been known there for many years. Has been known to breed in the same tree with the Wood Duck" (Peck). Des Moines—two specimens in the University museum were taken July 5 and Aug. 13, 1894, at Burlington, by Paul Bartsch. Franklin—"mature birds have been seen during latter May" (Shoemaker). Lee—"common migrant; rare summer resident"—Keokuk district" (Praeger); "abundant migrant; rare resident" (Currier). Winnebago—Hancock—"common migrant; rare summer resident. Have frequently seen young birds along wooded streams in August" (Anderson). Winneshiek—"common migrant in the spring; seen usually in May. I have never seen it in the fall. Observed as early as March 30 and as late as June" (Smith).

Subfamily ANATINÆ. River Ducks.

The Ducks of this subfamily are distinguished by the absence of a lobe on the hind toe. They are broad-billed ducks and feed by probing the bottoms of sluggish streams, ponds and marshes, picking up molluscs, crustaceans, insect larvæ, and the seeds and roots of aquatic plants. Many of our commonest ducks belong to this group.

Genus ANAS Linnæus.

Subgenus ANAS Linnæus.

30. (132). *Anas boschas* Linn. Mallard.

The Mallard, or typical "wild duck," from its close resemblance to its domesticated descendants, is probably the best known of all the species of ducks. It is a common migrant in all parts of the state, and at times abundant locally. Indeed, as Mr. Brewer has once said, during the migration season ducks are liable to alight wherever there is as much as a wash-basin of water. The Mallard nested very commonly in Iowa, particularly in the northern part of the state, until within a few years ago, and broods are still not infrequent in localities where undrained marshes are found of sufficient size to hide the young during the period of growth. The nest is almost invariably placed on dry ground, but not far from water.

T. M. Trippe (Proc. Bost. Soc., xv, 1872, 241) states that "a few remain all summer and breed. Said to have been in large numbers formerly" (Decatur and Mahaska). C. F. Henning (West. Orn., v, 3, 1900, 54–5) says that in former years the Mallard bred extensively in Boone county, but now only a few pairs remain. Most observers give the Mallard the status of only a migrant in Iowa. A few additional notes are given:

Blackhawk—"Common summer resident; nesting" (Walters); "abundant summer resident; nests" (Salisbury); "common migrant" (Peck). Jackson—"common resident" (Giddings). Hancock—"rather rare summer resident. Found a nest with nine fresh eggs, May 5, 1894, in Ellington township. The nest was on the ground, on a small knoll near a slough, placed under a small willow bush in high grass" (Anderson). Lee—"resident; breeds" (Praeger); "resident, not common; abundant migrant" (Currier). Pottawattamie—Mills—"abundant migrant; formerly rare summer resident" (Trostler). Poweshiek—"rarely breeds" (L. Jones). Linn—"no recent records of breeding here, though formerly they bred, according to 'old settler' reports" (Keyes). Winnebago—"found one nest in May, 1901, near Rake" (Halvorsen); "abundant migrant; formerly a common summer resident, but now rare, although a few still nest in the county" (Anderson). Woodbury—"common summer resident" (Rich).

In the spring and fall the Mallards frequently range over stubble-fields and corn-fields, particularly in the evening and early morning, picking up grain that has fallen on the ground. Sometimes, in early spring, large flocks are delayed by snow and sleet storms, and fall an easy prey to gunners. The Mallard appears early in the season—from early March until May, usually,—and lingers in the fall until the streams and ponds freeze over, often until December, in the northern part of the state.

31. (133). *Anas obscura* Gmel. Black Duck.

This species has recently been divided into two forms (*Anas obscura* Gmel. and *Anas obscura rubripes* Brewst.) and it is probable that some of the records refer to the latter form. I have no positive proof of *rubripes* having been taken in Iowa.

The Black Duck is principally a bird of the Eastern states, particularly the Atlantic coast, and Iowa is very near the western limit of its range. Stragglers, however, have been taken as far west as Nebraska and Kansas.

J. A. Allen states that it is "not uncommon in summer along the rivers and in grassy ponds" (Mem. Bost. Soc., i, 1868, 50).

County records: Blackhawk—"rare transient" (Salisbury); "has been known to occur two or three times in the county" (Peck); "rare migrant; specimen in Iowa State Normal School museum" (Walters). Cerro Gordo—specimens have been taken at Clear Lake, according to Richardson and others (Anderson). Delaware—(Mrs. M. A. Triem). Des Moines—Two specimens in the University museum; male, March 21, 1892; female, March 22, 1893, taken at Burlington by Paul Bartsch. Jackson—"rare transient" (Giddings). Lee—"migrant; irregular in numbers and occurrence" (Currier); "rare migrant; Keokuk district" (Praeger). Pottawattamie—Mills—"rare migrant; Manawa Lake, Oct. 20, 1894; Oct. 30, 1895. Missouri River, Iowa side (Mills) Oct. 29, 1896, and Nov. 2, 1896—birds killed by myself and others from flocks of *Anas boschas*" (Trostler). Poweshiek—"rare transient" (Kelsey). Webster—"rare. In the spring of 1893 a few were reported, and in May, 1897, one was killed here and brought to me for identification. It was about normal except neck slightly barred and lining of wing black rather than dusky" (Somes). Winnebago—"rare; took a young male in my collection at Rice

Lake, Oct. 8, 1888. It was with a flock of Mallards" (Richardson); "Julius George shot one at Thompson in 1903, and I traded a Mallard for it" (Halvorsen).

Genus CHAULELASMUS Bonaparte.

32. (135). *Chaulelasmus streperus* (Linn.). Gadwall.

The Gadwall or Gray Duck is reported by most observers in the state as a tolerably common migrant, though a few report it as rare. Keyes and Williams (Birds of Iowa, Proc. Davenport Acad. Sci., 1889, 116) gives the Gadwall as a "spring and fall migrant, rather common. Doubtless breeds in northern Iowa, inasmuch as the young have been taken at 'the Lakes' in August."

No records of the species nesting in Iowa came to my notice until W. H. Bingaman sent me a check list on which was marked "rare; two nests taken" (Kossuth county). In a recent letter he says: "I secured a set of ten eggs of the Gadwall at Anderson's Slough, five miles northwest of Algona, on May 29, 1901. Have found the young almost every year since at that place. It is also reported breeding at Union Slough in this county.

Genus MARECA Stephens.

33. (137). *Mareca americana* (Gmel.) Baldpate.

The Baldpate or American Widgeon is a tolerably common migrant in most parts of the state, only a few observers reporting it rare. It appears to be more uniformly common along the Mississippi and Missouri rivers than in the interior of the state. C. F. Henning states that "this handsome species arrives a little later than some of the other ducks, and prefers the Des Moines River to the small ponds. It is rarely met with in Boone county." According to Kumlien and Hollister (Bds. of Wis., 1903, 18), "this species is to a certain extent a parasite of the Canvasback, allowing the latter to dive and bring to the surface a bill full of Naiadaceæ, and gobbling up the nutlets before the rightful owner can get at them." The Baldpate is not known to nest in Iowa. In North Dakota, where I found many nests of the species in 1899, the eggs were deposited later in the season than those of most other ducks, very few sets being completed before June 20.

Genus NETTION Kaup.

34. (139). *Nettion carolinensis* (Gmel.) Green-winged Teal.

This little Teal is reported by all observers who furnished lists as either a common or abundant migrant. It is not known to nest in the state, breeding in general north of the United States boundary.

"Like the Mallard, this is a hardy species, and remains to winter just as far north as open water extends. . . . In the fall of 1884 the bulk arrived at Des Moines October 25, and the last left there November 17. In the spring of 1885 the record of its northern migration was too irregular to be of much value. It was recorded from Des Moines March 18; Heron Lake, Minn., March 26. In the fall of 1885 the first was seen at Des Moines Sept. 10. None was seen at Des Moines after Nov. 4" (Cooke, Bird Migr. in Miss. Val.). On Feb. 29, 1896, I shot a male specimen which was sitting with two others on the ice in Lime Creek just south of Forest City, in Hancock county—my earliest record for that locality.

The habits of the Green-winged Teal are very similar to those of the other river ducks.

Genus QUERQUEDULA Stephens.

35. (140). *Querquedula discors* (Linn.). Blue-winged Teal.

The Blue-winged Teal is probably the commonest of the species of ducks which are found in Iowa. Both sexes may be recognized by the patch of clear grayish blue on the wing coverts. It occurs abundantly as a migrant in all parts of the state, arriving somewhat later in the spring than the bulk of the ducks, seldom appearing in northern Iowa before April 1, and passing to the south before the great flights arrive from the north, usually before the last of September. It nests rather commonly in various localities in the state, wherever sloughs or the marshy borders of ponds render them reasonably free from molestation.

The young of this species are hatched about the middle of June and the downy little ducks leave the nest as soon as the shell is off their backs. Fresh eggs may be found from the middle to the last of May, although an accident to the first set may cause a second set to be deposited later in the season. On June 12, 1894, I procured a set of ten fresh eggs which were taken the day

before in Hancock county, evidently a delayed set. The nest, so far as my observation goes, is invariably built on dry ground, generally not far from a marsh or other body of water, being simply a slight hollow in the ground, lined with fine dry grass and soft gray down from the duck's breast. The tiny pellets of down are dark gray-colored, with paler center, which gives the down of the nest a mottled appearance. The female duck frequently leaves the nest for the greater part of the day, pulling a compactly-adhering cushion of down together so as to completely cover the eggs, keeping them warm and at the same time concealing them admirably. On more than one occasion I have visited a Teal's nest, where almost the exact location was known, and been obliged to search carefully for some time before finding the nest again. A nest found June 3, 1894, contained ten eggs, advanced in incubation; shape elongated oval and pale buffy or creamy in color. The nest was placed a few rods from a slough, on dry ground, where the meadow grass was about eight inches high (Winnebago). May 15, 1897, found a nest with seven fresh eggs, on a hummock in a dry slough, surrounded by long, wiry, slough grass; female on nest; May 25, 1897, seven fresh eggs (Hancock).

County records (other than in migration): Boone—"a few remain to breed" (Henning). Kossuth—"common; breeds near Union Slough" (Bingaman). Lee—"summer resident; breeds—Keokuk district" (Praeger). Winnebago—"summer resident; nests" (Halvorsen). Winneshiek—"probably breeds" (Smith).

36. (141). *Querquedula cyanoptera* (Vieill.). Cinnamon Teal.

This beautiful Western species occasionally appears in Iowa as a straggler. The male has the under parts deep cinnamon; the female closely resembles the same sex of *Querquedula discors*. The species has been taken in Minnesota, Wisconsin, Illinois, and Nebraska. "Reported from Omaha, April 10, 1896, and April 12, 1897" (Rev. Bds. Neb., 27).

County records: Blackhawk—"migrant; specimen mounted by myself in museum I. S. N. S." (Walters). Jackson—"Sabula—rare; have had hunters tell me they had shot it a few times" (Giddings). Pottawattamie—Mills—"I saw two that were killed by sportsmen April 8, 1894, at Big Lake (Pottawattamie), and several more that were killed in Mills county March 26, 1897, (south

of Manawa Lake)" (Trostler). Woodbury—"There have been three or four birds shot in the neigborhood of Sioux City, but whether in the state I can't say. I have only one measurement, from a Nebraska bird shot in April, 1897" (Rich).

Genus SPATULA Boie.

37. (142). *Spatula clypeata* (Linn.). Shoveller.

The Shoveller or Spoonbill Duck is a common migrant in all parts of the state; reported by nearly all observers. I have been unable to find any authentic records of its nesting in the state of Iowa, though small numbers are present during the summer among the lakes and marshes of the northern counties. W. W. Cooke (Bird Migr. in Miss. Val., 69) says: "Breeds in great numbers at Heron Lake, Minn. Its time of migration is two or three days behind that of the Gadwall. In the fall of 1884 the first Shoveller was reported from Des Moines, Oct. 28. In the spring of 1885 an early migrant was seen at Sioux City, March 27. The regular advance was reported from Des Moines and LaPorte City, March 21 and April 1. In the fall of 1885 the last at Heron Lake, Minn., was seen Nov. 12."

County records (summer): Boone—"used to breed in Boone county . . . now rarely seen during the summer months; may breed during favorable seasons" (Henning). Dickinson—"occasional summer resident at Spirit Lake" (Berry). Hancock—"common both in spring and fall migrations. In early spring they appear in small flocks, but later are seen only in pairs or singly. May 25, 1895, saw large numbers at Goose Lake; one male shot May 26, 1895, at Lake Edwards; May 28 and 29, 1897, numbers seen; June 12, 1896, one male seen in a pond by the roadside; very tame" (Anderson). Winnebago—common migrant; one seen on Rice Lake June 1, 1895 (Anderson).

Genus DAFILA Boie.

38. (143). *Dafila acuta* (Linn.). Pintail.

The Pintail is one of the commonest migrant ducks which are found in Iowa. It is one of the hardiest ducks and migrates early, frequently appearing in northern Iowa early in March. A few individuals and pairs remain in northern Iowa during the summer, and very rarely breed. "They breed principally in

British America, but also at Spirit Lake, Iowa, Heron Lake, Minn., and sparingly in northern Illinois" (Cooke, Bird Migr. in Miss. Val., 68). N. S. Goss (Birds of Kansas, 71) says: "Their nests are placed on low but dry, grassy land, and not far from the water, usually under the shelter of a bush; a mere depression in the ground, lined with grass and down. Eggs usually seven to ten. A set of seven, collected May 1, 1879, in Hancock county, Iowa (extreme southern breeding limits known) . . . pale grayish green to olive buff; in form, oval to ovate." The writer observed one nest in Hancock county, May 26, 1894, on freshly broken prairie sod, near a large slough; birds seen. In north Dakota I have frequently found nests in old wheat stubble. Dr. B. H. Bailey shot a female July 18, 1902, at Eagle Lake, Hancock county, and saw several others. C. F. Henning states that the species used to breed in Boone county, but they now go farther north.

M. E. Halvorsen wrote me that the Pintails were still staying around, May 22, 1901, in the vicinity of Rake, Winnebago county. I also saw two males as late as May 25, 1897, in Hancock county. E. S. Currier reports that the Pintail is a very abundant migrant, and a winter resident in mild winters, in Lee county. All other observers report it as a common or abundant migrant, particularly in the spring. It appears to be much less frequently observed in the fall.

Genus Aix Boie.

39. (144). *Aix sponsa* (Linn.). Wood Duck.

The Wood Duck or Summer Duck, the most elegantly plumaged of our native ducks, is a tolerably common migrant in all parts of the state. It formerly nested quite commonly around all water courses or lakes bordered by timber, where the nest was placed in hollow trees. The Wood Duck still rears its young in many favorable localities, but its numbers have greatly diminished of late years. The species is sometimes domesticated.

Thomas Say (Long's Exp., i, 267–270) mentions the occurrence of the Summer Ducks (*Aix sponsa*) with their young, May 30, 1820, at Engineers' Cantonment. Prince Maximilian, in his journey up the Missouri, in April, 1833, and May, 1834, mentions the large numbers of paired Wood Ducks seen everywhere

(Reise, i, 282; ii, 339–40). "Rather common; breeds"—Decatur and Mahaska (T. M. Trippe, Proc. Bost. Soc., xv, 1872, 241).

Morton E. Peck states: "Formerly it was the most common of the ducks breeding in the valley of the Cedar. In late summer the ponds and small streams swarmed with the young birds. Within the past ten years they have almost ceased to breed in Blackhawk county. Rare in Linn and Hardin counties." "I know of four places where four families of Wood Ducks were reared last year (1905) in Jasper county" (J. L. Sloanaker). In Winnebago and Hancock counties a few pairs are found every summer along Lime Creek. In the western part of the state the Wood Duck appears to be less common than in the eastern portions. Dr. Trostler reports it as a rare summer resident in Pottawattamie county, and Dr. Rich that it is an uncommon transient and has bred in the vicinity of Sioux City.

The Wood Duck is remarkable for its habit of frequently alighting in trees and also for foraging in the timber, feeding largely on acorns at certain seasons. It is quite a hardy species, appearing early in the spring and remaining until late October.

Subfamily FULIGULINÆ. Sea Ducks.

The members of this subfamily are distinguished from the preceding by the presence of a lobe or web on the hind toe. They usually frequent open water,—bays, lakes, etc.,—and obtain their food principally by diving, sometimes descending to a great depth. Their food consists principally of molluscs, crustaceans, and the seeds and roots of aquatic plants.

Genus AYTHYA Boie.

Subgenus AYTHYA Boie.

40. (146). *Aythya americana* (Eyt.). Redhead.

The Redhead is very generally distributed over the state during the migrations, but very few observers class it as common in the interior of the state. Along the Mississippi River it seems to be more common. In the Keokuk district it is given as a "common migrant" (Praeger); Lee—"migrant, in irregular abundance" (Currier); Jackson—"common transient" (Giddings). On the Missouri, Dr. Trostler reports it as an abundant migrant in Pottawattamie and Mills.

It is doubtful whether the Redhead nests in Iowa at the present time, as no observers have reported the species in summer during recent years. G. H. Berry reported it as a "rare summer resident" at Spirit Lake in 1891–2. In 1885 the most southerly breeding reported to W. W. Cooke came from Clear Lake, Iowa (Bird Migr. in Miss. Val., 70). P. B. Peabody took a set of eggs at Heron Lake, Minn., June 22, 1895, (Oöl., xii, 8, 1895, 126).

The Redhead is quite often confused with the Canvas-back by untrained observers, but the two species are easily distinguished in any plumage. The Redhead's forehead arches abruptly up and away from the base of the bill, while the Canvas-back's bill slopes gradually up to the top of the head in line with the sweep of the forehead, somewhat like a Goose's in shape.

The Redhead and Canvas-back are among the few species of ducks which usually build their nests directly over the water. All nests which I have examined resembled those of the American Coot, being a platform of dead rushes bent down over the water.

41. (147). *Aythya vallisneria* (Wils.). Canvas-back

The Canvas-back, from its supposed preëminence as a table duck, has been hunted so pesistently all over the United States that it now appears to be rarely seen in Iowa even as a migrant. Most observers consider it as a rare migrant, or irregular. Only three observers report it as at all common. In the Keokuk district Praeger gives it as a common migrant; Currier, in Lee county, as a migrant, irregular in abundance. Dr. Trostler lists it as an abundant migrant in Pottawattamie and Mills.

There are no records of the Canvas-back nesting in Iowa, though the birds may linger late in the spring in favorable localities. In a letter of May 22, 1901, M.E.Halvorsen wrote me: "There are two or three pairs of Canvas-backs that seem to be nesting down around the Buffalo Fork swamp, but I have not been able to find any nests yet" (Rake, Winnebago county).

When feeding upon wild celery the flesh of the Canvas-back is said to acquire a peculiarly fine flavor. "Mr. Skavlem of Janesville has shown that the so-called 'celery buds' upon which these ducks often feed are no part of the plant *Vallisneria spiralis*, but the bemmæ or nutlets of one of the pond-weed family (*Naiadaceæ*)." (Birds of Wis., 1903).

42. (148). *Aythya marila* Linn. Greater Scaup Duck.

The Great Scaup, Blackhead, or Bluebill is a common migrant in Iowa. It usually appears in large flocks early in the spring and late in the fall and shows a tendency to bunch together closely in the water. There are no recent records of the species breeding in the state. W. W. Cooke (Bird Migr. in Miss. Val., 71), says: "The most southern breeding record of this species was at Clear Lake, Iowa (lat. 43° 26')." John Krider (Forty Years' Notes of a Field Ornithologist, 74) says of *Fulix marila* Baird: "I found one breeding in Iowa in 1874. Eggs eight. Shot the parent bird in Lime Creek."

The Greater Scaup is reported by nearly all observers as a common migrant, but as somewhat rare by Currier and Praeger (Keokuk district), and by Savage (Van Buren).

43. (149). *Aythya affinis* (Eyt.). Lesser Scaup Duck.

The Lesser Scaup, Little Blackhead, or Little Bluebill is a common migrant over all parts of the state, being classed as abundant by some observers. It seems to be generally more numerous than the preceding species, which it resembles in appearance and habits, and with which it is often confused.

The Lesser Scaup is known to nest in Iowa, but very rarely and locally. W. W. Cooke (Bird Migr. in Miss. Val., 71) says that it is known to breed as far south as Clear Lake, Iowa. John Krider gives the species as breeding in Iowa and Minnesota (Forty Years' Notes, 74).

Wm. E. Praeger reports it to be "an abundant migrant. Evidence as to its breeding is circumstantial. I have positively identified the birds on June 11 and July 4. Have heard several times of broods seen with their parents in the neighborhood, and all hunters say it breeds, but of course you know what questionable recorders they are. However, I am of the opinion that it breeds in small numbers" (Keokuk district).

From the same locality Edmonde S. Currier reports: "Summer resident, rare; winter resident, not common; migrant, abundant. I know this bird to be a rare summer resident along the Mississippi, near Keokuk, and have observed it in June and July. June 25, 1896, an old duck and four young were seen in the canal three miles north of Keokuk, and three of the young were killed. I

talked with the party who got them, and from his description of the bird I do not doubt but what it was this species. I think that they occasionally nest on the levee or 'dump' between the Mississippi River and the Des Moines Rapids canal. This dump is seven miles long, and being isolated, is only visited by fishermen," etc. (Lee county).

Dr. B. H. Bailey observed several Lesser Scaups at Eagle Lake, Hancock county, July 17–20, 1902, and took one old bird and several young in the down.

44. (150). *Aythya collaris* (Donov.). Ring-necked Duck.

The Ring-necked Duck or Ring-bill is generally distributed over the state during migrations. There is some variance in the reports as to number, a few observers considering the species rare or uncommon, while the majority list it as common or even abundant. Its habits are similar to those of the Scaups. Keyes and Williams (Birds of Iowa, 168) give it as a spring and fall migrant, abundant from the middle of March to the middle of April, and from the middle of October to the middle of November. Sometimes winters about the rapids in the streams, even in the northern part of the state." The only record observer who reports the Ring-necked Duck other than as a migrant is G. H. Berry, who lists it as an "occasional resident" in Linn county. "It was reported breeding at Clear Lake, Iowa, and thence northward" (Cooke, Bird Migr. in Miss. Val., 1884–5, 72).

Genus CLANGULA Leach.

45. (151). *Clangula clangula americana* Faxon. American Golden-eye.

The American Golden-eye or Whistler is rather an uncommon migrant in most parts of the state. A few observers report it as a common migrant, remaining all winter where there is open water. It does not breed in the state.

The Golden-eye was reported as a migrant in Franklin county (Shoemaker); Cerro Gordo—"frequent at Clear Lake" (Richardson); Woodbury—(Rich); Polk—(Johnson); Sioux—(Johnson); Webster—(Somes); Linn—(Bailey); Blackhawk—(Walters); Jackson—(Giddings); Kossuth—(Bingaman); Winnebago—(Anderson); Poweshiek—(Kelsey).

"Found in Blackhawk county in winter and early spring on the Cedar; scarce" (Peck). Linn—"rare winter resident" (Berry); Lee—"abundant winter resident—Keokuk district" (Praeger); "winter resident; very abundant" (Currier). Scott—"common winter resident when river is open—Rock Island" (Wilson). Des Moines—Specimens in University museum, taken Jan. 29, 1893; March 22, 1893; Nov. 11, 1894, Burlington, by Paul Bartsch.

46. (152). *Clangula islandica* (Gmel.). Barrow Golden-eye.

The Barrow Golden-eye is a very rare or infrequent visitor in the state. This is even a more hardy species than the preceding and is most apt to occur in the winter where open water is found. A specimen in the University museum was taken at Independence Oct. 11, 1892, by Robert E. Leach, (C. C. Nutting, Proc. Iowa Acad. Sci., 1892, 40). It was reported from Pottawattamie and Mills as a "rare migrant" (Trostler); Linn—"rare winter visitant" (Berry); Lee—"rare winter resident—Keokuk district" (Praeger); "rare winter visitant" (Currier).

"Last year one was sent me from near the Iowa state line which was a typical bird, and Dr. Hvoslef (Lanesboro) has a female of this species in typical plumage" (Hatch, Bds. of Minn., 65). "A rare winter visitant in eastern Nebraska; more numerous westward. Reported from Omaha," etc. (Rev. Bds. Neb., 28–29).

Genus CHARITONETTA Stejnejer.

47. (153). *Charitonetta albeola* (Linn.). Buffle-head.

The Buffle-head, Butter-duck, or Spirit Duck is a common migrant in nearly all parts of the state. It seems to be rarer along the Missouri, being reported as a "scarce migrant in Pottawattamie and Mills" (Trostler), and as an "uncommon transient" at Sioux City (Rich). W. W. Cooke states that it "breeds at Clear Lake, Iowa, and Heron Lake, Minn., and northward" (Bird Migr. in Miss. Val., 73), but it is not known to remain during the summer at the present time. The Buffle-head is a very expert diver, and relying upon its agility for protection, sometimes lets a hunter approach quite closely.

Genus HARELDA Stephens.

48. (154). *Harelda hyemalis* (Linn.). Old-squaw.

The Old-squaw or Long-tailed Duck is a far Northern visitor

which is an irregular and rather uncommon winter visitant on the larger rivers and streams of the state. The species is mentioned by Thomas Say as occurring at Engineers' Cantonment during the winter of 1819–20 (Long's Exp., i, 267). It is also listed by J. A. Allen (White's Geol. of Iowa, ii, 427). Prof. C. C. Nutting records a specimen in the University museum, No. 10176, taken Nov. 29, 1892, at Burlington, by Paul Bartsch (Proc. Iowa Acad. Sci., 1892, 44). "A regular but not common winter visitor, specimens being taken every winter on the Missouri River in the vicinity of Omaha" (Rev. Bds. Neb., 29).

County records: Des Moines—Museum Nos. 14157, Nov. 22, 1895, male; 16063, Nov. 23, 1895; Burlington (Bartsch). Jackson —"rare transient" (Giddings). Lee—"rare migrant—Keokuk district" (Praeger); "rare visitant" (Currier). Pottawattamie— "straggler" (Trostler). Woodbury—"only record, a bird shot at Rodney, Iowa, January, 1904. I saw the bird, typical winter plumage, probably male" (Rich).

Genus HISTRIONICUS Lesson.

49. (155). *Histrionicus histrionicus* (Linn.). Harlequin Duck.

The Harlequin Duck is another northern species which occasionally straggles into the Mississippi Valley in winter or during the migrations. It has been taken in winter in Wisconsin and Illinois and as far south as St. Louis, Mo. "Two definite records for Nebraska, I. S. Trostler recording the taking of two specimens on the Missouri River at Omaha, Sept. 16, 1893, and of another at Florence Lake, near Omaha, Sept. 19, 1895" (Rev. Bds. Neb., 29.)

County records: Pottawattamie—"Two Harlequin Ducks were brought to me for identification. They were killed at Big Lake, Pottawattamie county, Sept. 26, 1895" (Trostler). Sioux—"saw a part of a skin—head, skin of one side, and wing—shot at Hawarden in 1886." (Berry). Van Buren—"about eleven years ago a hunter shot three at one shot. This is the only time I ever knew of them being in our locality—Hillsboro" (W. G. Savage).

Genus SOMATERIA Leach.

50. (160). *Somateria dresseri* Sharpe. American Eider.

The American Eider is only an accidental visitor in Iowa. G. H. Berry reports it as a "rare winter visitant" in Linn county.

Dr. G.C. Rich writes: "Rare transient. I have a mounted specimen, male, shot in Woodbury county, Nov. 1, 1901."

Kumlien and Hollister report it as rare on Lake Michigan in winter, Racine, 1875 (Hoy); two at Milwaukee; one at Lake Koshkonong, Nov. 1891 (Bds. of Wis., 25–26).

Subgenus ERITONETTA Coues.

51. (162). *Somateria spectabilis* (Linn.). King Eider.

Like the preceding, the King Eider is an Arctic species and there is only one record of its occurence in Iowa.

Wm. E. Praeger, Keokuk, Iowa: "On the 18th of November, 1894, a boy brought me a *Somateria spectabilis* that he had shot on the Mississippi. It was a male in brown plumage, but showing a few black and white feathers. The stomach contained nothing but fine quartz gravel." (Iowa Orn., i, 2, 1895, 52. Reprinted from The Auk). E. S. Currier also states there is a "male in Mr. Praeger's collection, killed on Des Moines Rapids" (Lee county)

Genus OIDEMIA Fleming.

Subgenus OIDEMIA Fleming.

52. (163). *Oidemia americana* Sw. and Rich. American Scoter.

The American Scoter can only be considered a rare or casual visitor in Iowa. The Scoters or Sea Coots are most abundant along the coasts and bays, feeding upon mussels, clams, etc. Kumlien and Hollister give the American Scoter as a "rather common winter resident on Lake Michigan. Less common in the interior, occurring principally as a migrant" (Bds. of Wis., 26).

County records: Blackhawk—"a casual specimen taken some years ago" (Peck). Jackson—"rare transient" (Giddings). Lee —"one specimen taken Oct. 31, 1891—the only record" (Praeger); "rare visitor" (Currier). Linn—"tolerably common winter visitant" (Berry). Pottawattamie—"straggler; Cut-off Lake, Iowa (No-man's Land); several killed by Omaha sportsmen and mounted by taxidermists" (Trostler).

Subgenus MELANITTA Boie.

53. (164). *Oidemia deglandi* Bonap. White-winged Scoter.

The White-winged Scoter appears to be more common in the interior than the other two species. It occurs in Iowa only as a

migrant. The White-winged Scoter, until the last few years, was known to breed only in British America and Labrador, but recently a few nests have been found in restricted localities in North Dakota. In 1899 the writer found one White-winged Scoter's nest with ten eggs, June 23, and one containing eleven eggs and three eggs of the Baldpate, on June 25; both nests on the ground on small rocky islands in the Devil's Lake region. The latter nest was placed uuder a small wild gooseberry bush, and I caught the female duck on the nest with my hands.

County records: Blackhawk—"one specimen taken some years ago and a few others observed" (Peck). Des Moines—"Nov. 15, 1890, Burlington, by Paul Bartsch" (C. C. Nutting, Proc. Iowa Acad. Sci., 1894, 44). Clay—Palo Alto—"Nov. 24, 1891, received a male which, with one other, was obtained from a flock of five at Lost Island Lake, Iowa" (Frank W. Sheldon, O. & O., March, 1892, xvii, 3, 46). Lee—"one specimen taken Oct. 26, 1894—only record—Keokuk district" (Praeger); "rare visitor; specimen in Mr. Praeger's collection" (Currier). Linn—"fall migrant" (Bailey); "tolerably common winter visitant" (Berry). Palo Alto—"mounted and photographed a female shot by M. Shaw at Pickerel Lake, October, 1902" (A. D. Whedon). Woodbury—"rare transient" (Rich); a female specimen sent to the University museum was killed Nov. 16, 1903, at Crystal Lake, Neb., an old channel of the Missouri River, two and one-half miles southwest of Sioux City, Iowa, by R. E. Rathbone.

Subgenus PELIONETTA Kaup.

54. (166). *Oidemia perspicillata* (Linn.). Surf Scoter.

The Surf Scoter is only a casual visitor in Iowa. W. W. Cooke states that it "occurs in winter on all the larger streams in Illinois, as well as on Lake Michigan. Has been taken at St. Louis, Mo., and at LaPorte City, Iowa."

County records: Des Moines—two specimens in University museum, collected at Burlington by Paul Bartsch; No. 16077, male juv., March 28, 1893; No. 16079, Nov. 22, 1895. Lee—"one specimen Oct. 20, 1895, and one Oct. 22, 1896, are my only records—Keokuk district" (Praeger). Linn—"rare winter visitant" (Berry). Pottawattamie—"Iowa side of Cut-off Lake (No-man's-Land); straggler" (Trostler).

Genus ERISMATURA Bonaparte.

55. (167). *Erismatura rubida* (Gmel.). Ruddy Duck.

The Ruddy Duck is quite generally distributed over Iowa during the spring and fall migrations, but appears to be somewhat locally distributed and in irregular numbers. A few undoubtedly breed in favored localities in the state. Dr. B. H. Bailey writes: "I did not personally collect eggs of the Ruddy Duck, but am positive that they nest at Eagle Lake (Hancock county), as they are there in full breeding plumage and the boys there have found their nests. I shot a male in full plumage there about June 15, 1903."

County records: Blackhawk—"rare migrant" (Walters); "a scarce but regular migrant" (Peck). Boone—"rare migrant" (Henning). Hancock—"pair seen on Lake Edwards, May 5, 1893; male shot" (Anderson). Howard—"the Ruddy Duck I have shot at Cresco" (E. B. Webster). Johnson—occasional migrant; female shot April 27, 1902, above Coralville (Anderson). Lee—"common migrant" (Praeger); "migrant, in irregular abundance" (Currier). Linn—"migrant" (Bailey). Polk—"migrant" (Johnson). Pottawattamie—Mills—"common migrant" (Trostler). Des Moines, Nov. 11, 1890, male and female; Oct. 22, 1895, female, Burlington, (Bartsch). Scott—"migrant; Mississippi River" (Wilson). Winnebago—"rare; have seen a few on Rice Lake" (Richardson). Woodbury—"uncommon transient" (Rich).

Subfamily ANSERINÆ Geese.

The Geese are large birds, much more terrestrial than the Ducks, and feed principally upon grass and green vegetation. When on the water they feed much as the river ducks do, by dipping the head and neck under water with the tail pointing upward. At least eight species and varieties are found in Iowa, all of which are migratory, only one species breeding in the state at all, and that only in very small numbers.

Genus CHEN Boie.

56. (169). *Chen hyperborea* (Pall.). Lesser Snow Goose.

The Leser and Greater Snow Geese, both of which are found in Iowa during the migrations, resemble each other so closely in form and coloration that they are only distinguishable from each

other by their measurements. Dr. Coues says of the Greater Snow Goose (Key to N. A. Birds, 5th Ed., ii, 900): "The dimensions grade down to those of the preceding; both vary much and are specifically inseparable, but their extremes are far apart, and there is generally a difference which enables us to refer specimens to one or the other." The Lesser Snow Goose is said by most authorities to be found chiefly in western North America, commonly in the Mississippi Valley, and less regularly along the Atlantic coast; while the Greater Snow Goose is said to be confined more to eastern North America. Both species breed in the far north, passing through the United States only during migrations. Both species are commonly known as "White Brant" in Iowa, and their close similarity has led to great confusion of records, it being practically impossible to distinguish them apart unless the bird is in the hand.

The reports of observers vary as to its abundance: Blackhawk—"occasional migrant" (Walters); "frequent migrant" (Peck). Decatur—Mahaska—"common spring and fall migrant; rarely alights" (Trippe, Proc. Bost. Soc., xv, 1872, 241). Franklin—"abundant migrant" (Shoemaker). Boone—"comes to us from the south sometimes as early as January, and scatter along through February and March, according to the season. Can often be found along the Des Moines River, at times in company with the more hardy species of ducks" (Henning). Jackson—"rare transient" (Giddings). Lee—(reported by H. W. Parker, Am. Nat., v, 1871, 169); "rare migrant" (Praeger); "migrant, not common" (Currier). Linn—"spring and fall migrant" (Bailey). Polk—Sioux—"migrant" (Johnson). Pottawattamie—Mills—"common migrant" (Trostler). Scott—"rare transient; always seen in flocks with the Canada Goose. Seven April 16, 1886; four March 22, 1890; four April 1, 1891" (Wilson). Van Buren—"spring migrant, very rare" (Savage). Winnebago—"migrant" (Halvorsen); "I have only observed it as a rare straggler with flocks of American White-fronted Geese" (Anderson). Woodbury—"common transient. The Lesser is often in the market" (Rich). John Krider (Forty Years' Notes, 71), states that he found it in Iowa, where they pass in great numbers in April, stopping to feed in the grain fields."

The Museum of Natural History in the State University of

Iowa contains a very large series of Snow Geese in the D. H. Talbot collection, mostly collected in the Mississippi Valley. The writer examined and took careful measurements of seventy-eight skins collected in Iowa. The length of wing (from bend of closed wing to tip of longest primary), and the length of bill (chord of the culmen) being the most constant dimensions, were taken as a basis of comparison for determining what proportion might be referred to *Chen hyperborea* and what to *Chen hyperborea nivalis*. Dr. Coues gives the average measurements of *C. hyperborea* as: Length about 25.00; wing 14.50–17-00; tail 5.50; tarsus 2.73–3.25; bill 2.00–2.12. *Chen hyperborea nivalis*—length 27.00–31.00 or more; wing 17.00 or more; tail 6.50; tarsus 3.00–3.50; bill 2.35–2.65.

One of the specimens measured was taken at Sloan, Iowa, and all of the others at Whiting, Iowa, from March 7 to April 8, 1885, and March 23 to April 6, 1886. Three specimens had wings measuring less than 15 inches; thirty specimens between 15 and 16 inches; seventeen between 16 and 16.50 inches; twenty between 16.50 and 17 inches; and eight over 17 inches, the maximum being 17.50 inches. Twenty-six specimens had bill measuring between 1.90 and 2.12 inches (*hyperborea*); forty-two between 2.12 and 2.35 inches (intermediate); and ten over 2.35 inches, the maximum being 2.48 inches (*nivatis*). On the basis of these measurements only ten or twelve per cent of the specimens from Iowa can definitely be considered as Greater Snow Geese, the remainder being the Lesser variety, with every grade of intermediates between. In the face of such perfect intergradation, the attempt to differentiate between the varieties seems to be almost a useless refinement.

57. (169a). *Chen hyperborea nivalis* (Forst.). Greater Snow Goose.

What has been said under the preceding species applies equally to this variety. It appears to be less common in Iowa than the Lesser Snow Goose, but unless birds are captured it is impossible for an observer to distinguish between the two. In Wisconsin, Kumlien and Hollister class the Greater Snow Goose as a "migrant, formerly abundant, but now rather rare. . . . Of the specimens examined, taken during the past sixty years and mostly when the birds were abundant, about one-half are typical of either

hyperborea or *nivalis*, and in about equal numbers, the balance intermediate. They feed sparingly now about the larger cornfields in Southern Wisconsin, especially in spring, where they formerly resorted in large numbers" (Birds of Wis., 1903, 27).

County records. Blackhawk—"rare transient" (Salisbury). Cerro Gordo—"commonly called Brant in this locality" (Richardson). Linn—"tolerably common migrant. In spring of 1898 two hunters shot twenty-seven Snow Geese in one day, at Cone, Iowa" (Berry). Pottawattamie—Mills—"common migrant" (Trostler). Warren—"rare migrant" (Jeffrey). Winnebago—"taken at Forest City" (Anderson). Woodbury—"common transient. I am quite sure that I have seen large and small white geese in the markets of Sioux City, not in late years, however" (Rich).

58. (169.1). *Chen cærulescens* (Linn.). Blue Goose.

The Blue Goose is quite rare in Iowa, which appears to be its status everywhere in the United States. W. W. Cooke states that it "breeds on Hudson Bay, migrates through the Mississippi Valley. During migrations it was noticed at Burlington, Iowa, where the bulk arrived March 20, 1884" (Bird Migr. in Miss. Val., 1884–5, 74). Kumlien and Hollister state that "it is of irregular and erratic occurrence anywhere in Wisconsin except along the Mississippi" (Bds. of Wis., 28).

County records. Blackhawk—"a regular and not uncommon migrant across Blackhawk county. Sometimes alights in cornfields in the spring migration" (Peck). Lee—"rare migrant"—Keokuk district" (Praeger). Linn—"spring and fall migrant" (Bailey). Pottawattamie—Mills—"scarce migrant" (Trostler).

The University museum contains six Iowa specimens. Male, March 12, 1891; female, March, 1891, Burlington, Paul Bartsch; two males, Clinton, C. P. Chase; male, March 30, 1886, Whiting, by A. T. Dailey; male, Whiting (no date).

Genus ANSER Brisson.

59. (171a). *Anser albifrons gambeli* (Hartl.). American White-fronted Goose.

The American White-fronted Goose is the species commonly called "Brant" or "Gray Brant" in Iowa. It is a tolerably common migrant in most parts of the state, appearing in the latter

part of March or first of April, and again in November, frequently alighting to feed in stubble-fields and corn-fields. They are usually seen in large flocks and may be recognized by the white forehead and whitish breast marked with black blotches. From the reports of observers the species appears to be more abundant in the northern part of the state and along the Missouri River than it is on the Mississippi. The Talbot collection in the University museum contains several specimens from Whiting, Iowa, which are very variable in the shade of upper parts and black spotting on belly. There are also two specimens from Burlington, collected by Paul Bartsch.

Genus BRANTA Scopoli.

60. (172). *Branta canadensis* (Linn.). Canada Goose.

The Canada Goose is the species commonly and popularly known as the "Wild Goose." It is the only Goose which is known to have nested in Iowa. Before the general settlement of the state the Canada Goose nested quite commonly in various parts of the state and a few pairs still linger throughout the summer in localities which are not too thickly settled. Eggs have frequently been taken, hatched under domestic fowls, and the young domesticated. I have seen specimens reared in this manner which became as tame as the domestic goose. In *Forest and Stream* (viii, 12, 177) there is an account of the domestication of the Canada Goose at Benson Grove, Winnebago county, Iowa. The University museum has a specimen, No. 9038, hybrid between the Common Goose and Canada Goose, bred by D. H. Talbot of Sioux City. The body is like that of the Canada Goose; forehead, lores, cheeks, and throat white; front of neck mottled, back of neck from center of head black, with a few white feathers; received Nov. 2, 1892.

The earliest Iowa record is probably that of Lewis and Clarke (Coues, Hist. of L. and C. Exp., i, 49): "Great quantities of young geese were seen today" (Fremont county, Iowa, a little above present site of Nebraska City, Neb.). "July 31—the hunters supplied us with deer, turkeys, geese, and beaver" (north of Boyer's Creek). Thomas Say (Long's Exp., i, 266–70) noted Canada Geese at Engineers' Cantonment, "flying to the north, Feb. 21, 1820." Prince Maximilian, (Reise, i, 282) says: "Auch

das nest einer wilden Gans (*Anser canadensis*) fanden wir auf einem solchen Baume" (near mouth Nadaway River, in Missouri, April 25, 1833). . . (i, 308–9), May 9, 1833, above mouth of Big Sioux), "An der Mündung des Ayowä (Ioway) Flusses, welcher an sudlichen Ufer sehr spitzwinklig in den Missouri tritt, . . . haufig beobachteten wir die wilden Gänse, die jetzt ehre kleinen Jungen, deren sie nie mehr als 4 bis 6 hatten, am Ufer vor uns in Sicherheit zu bringen suchten. Kam man ihnen sehr nahe, so flutterte die Mutter ängstlich fort und leiss ihre hochstimme hören." Audubon (Journals, i, 477) mentions observing geese at various points along the Missouri in 1843,—May 9 (near mouth of Platte); May 11 (below mouth of Little Sioux); May 13 (below mouth of Little Sioux) "we saw a good number of geese, though fewer than yesterday." (Ibid., ii, 173). Oct. 1, 1843, "geese very abundant" (mouth of Big Sioux.) "Camped at mouth of the Omaha River, six miles from the village. The wild geese are innumerable." Oct. 3—"passed the Little Sioux River. Saw . . . two Swans, several Pelicans, and abundance of Geese and Ducks. Passed Soldier River at three o'clock . . . killed two Mallards; the geese and ducks are abundant beyond description."

Keyes and Williams (Bds. of Iowa, 1889, 118) state that the species "breeds in the vicinity of Spirit Lake and other localities in northern Iowa." Most observers at the present time speak of the Canada Goose as a common or abundant migrant, flying in large V-shaped wedges as early in the spring as open water can be found, and returning with the first general freeze-up in the fall. Its resonant and sonorous "honk" is known to all.

The Canada Goose is only reported as a winter resident from the extreme southeastern portion of the state: "abundant migrant and winter resident—Keokuk district" (Praeger); "winter resident, common; formerly bred here—Lee" (Currier). "Usually reaches Boone county the last week in January, and from that on to the last of March, according to the season; formerly breeding" (Henning). The species is a common migrant in Winnebago and Hancock counties, but is exceedingly wary and very seldom captured. They formerly nested quite commonly in that locality, and a few isolated pairs have continued to remain during the summer until quite recently (four or five years ago) at Goose Lake and Eagle Lake (Hancock), along the Buffalo Forks (Winnebago),

and a few other suitable localities. In North Dakota I have seen nests placed both upon a muskrat house in the center of a large slough and upon the ground on small rocky islands.

The Canada Goose runs into varieties westward. The Museum of Natural History, State University of Iowa, has a series of over five hundred skins of *Branta canadensis*, mostly from Nebraska and Iowa, in which almost every phase of variation is represented. The greater number of the Iowa specimens are the large *canadensis* proper, but many specimens are found which are clearly referable to *hutchinsii* and *minima*.

A typical male in the University collection, shot by D. H. Talbot near Sioux City, Nov. 17, 1886, measured: extent (spread of wings) 72; wing 21½; tail 7¼; bill 2.44; weight 13½ pounds; tail 18-feathered; white cheek-patches confluent on throat.

61. (172a). *Branta canadensis hutchinsii* (Sw. and Rich.). Hutchins Goose.

The Hutchins Goose is colored exactly like the Canada Goose but its size is much less. Ridgway (Manual N. A. Birds) gives the average measurements: wings usually less than 16; culmen less than 1.75; length 25–34; wing 14.75–17–75; culmen 1.20–1.90; tail normally 16-feathered.

A specimen from the University museum, No. 6730, was identified by Robert Ridgway; male, shot by D. H. Talbot near Sloan, Iowa, April 14, 1884; wing 16.37; bill 1.52; narrow mottled black strip along median line of throat; conspicuous white collar on lower neck. There are several other specimens in the collection: 7953, Whiting, April 3, 1885; tail feathers 16; cheek-patches not separated. 6550, Whiting, April 16, 1884. 6636, Whiting, March 23, 1886; wing 15.50; culmen 1.60; weight 6 pounds. 6726, Whiting, spring, 1885; wing 18.37; bill 1.49; weight 3 pounds; tail 18-feathered; cheek-patches not separated.

Hutchins Goose breeds only in the far North, migrating chiefly through the western United States and Mississippi. It is frequently observed in Iowa as a migrant, every shade of intergradation between this variety and the true *canadensis* having been taken in the state.

County records: Delaware—(Mrs. M. A. Triem). Cerro Gordo —(Richardson). Linn—"spring and fall migrant" (Bailey). Polk

—"have one specimen killed at Twin Lakes, Iowa, now in the collection of the State Historical Department" (Johnson). Sioux —"rare migrant" (Berry). Pottawattamie—Mills—"abundant migrant" (Trostler). Winnebago—Hancock—"rare migrant" (Anderson). Woodbury—"uncommon transient—Sioux City" (Rich).

62. (172c). *Branta canadensis minima* Ridgway. Cackling Goose.

The Cackling Goose is the smallest representative of the *Branta canadensis* group. It is characterized by small size, dark under parts, white collar around lower neck usually very distinct; white cheek-patches usually separated by a black throat stripe or black mottling on throat. Ridgway gives the following as measurements: Length 23–25; wing 13.60–14.50; culmen .95–1.15; tail feathers usually 14 to 16.

Eleven specimens in the Talbot collection, taken in Iowa, are clearly referable to *minima*. Three were identified by Robert Ridgway, No's. 5077, 6586, and 7994.

5077. Whiting, Iowa, 1885; female; length 24.50; wing 13.37; bill 1.30; weight 3 lbs.; tail 16-feathered; grayish below, anal region white, sharply contrasted; black stripe continuous along throat from bill to neck, separating the white cheek-patches, lower portion of stripe mottled with white; whitish collar quite distinct at base of black neck. The bird was about the size of a Mallard Duck.

6586. Whiting, Iowa, April 6, 1886; length 25.75; wing 14.63; tail 5.25 (16-feathered); weight 3½ lbs.; cheek-patches separated by continuous black line, slightly mottled posteriorly.

7994. Whiting, Iowa, April 7, 1885; length 25.80; wing 14.50; tail 6.13 (14-feathered); weight 3½ lbs,; cheek-patches not separated in front.

8091. Whiting, Iowa, April 7, 1885; length 26.25; wing 14.13; bill 1.38; weight 3½ lbs; tail 16-feathered; white cheek-patches separated by black stripe; no white collar.

5116. Whiting, Iowa, April 7, 1885; length 26; wing 14.50; tail 6.00 (15-feathered); weight 3½ lbs.; white cheek-patches separated by only slight trace of black mottling on median line of throat anteriorly.

6543. Whiting, Iowa, April 7, 1885; length 26.50; wing 14 38; bill 1.25; tail 16-feathered; weight 5½ lbs.; faint traces of black mottling on median line of throat.

5344. Whiting, Iowa, March 23, 1886; weight 4½ lbs.; tail 14-feathered.

7988. Whiting, Iowa, April 7, 1885; weight 5 lbs.

5338. Whiting, Iowa.

6724. Wolf Creek, Iowa, April 5, 1884.

6728. Near Sloan, Iowa, April, 1884.

The Cackling Goose was not reported by any observers in the state and I am not aware of any published record of its occurrence in Iowa. It is chiefly an inhabitant of western North America, especially of the Pacific coast, and only occasionally appears in the Mississippi Valley. It has not been recorded farther east than Illinois and Wisconsin and there are no authentic published records from Nebraska, although I have examined several Nebraska specimens in the Talbot collection which are undoubtedly *minima*. The species must be considered as only a casual migrant in Iowa.

63. (173). *Branta bernicla glaucogastra* (Brehm). Brant.

The Brant or Brant Goose is chiefly found along the Atlantic coast and only rarely in the interior, principally along the Great Lakes and rivers in migration. The species breeds within the Arctic Circle. Dr. Coues (Birds of the Northwest, p. 557) says: "While ascending the Missouri in October, 1872, I observed vast numbers of the Common Brant in flocks on the banks and mudbars of the river."

County records: Blackhawk—"frequent migrant" (Peck). Boone—"rare migrant" (Henning). Iowa—"rare migrant; the only one I ever saw was shot at Amana in 1902" (Berry). Jackson—Sabula—"I have never handled specimens taken in Iowa, but have seen birds very close which I and others took for Brant" (H. A. Giddings). Poweshiek—"tolerably common transient" (Kelsey); "large flocks *B. brenta* Steph.; doubtless this species" (Poweshiek and Jasper, H. W. Parker, Am. Nat., v, 1871, 169).

The only definite record of this species for Nebraska is "reported by I. S. Trostler, who saw three that were killed on the Missouri River at Omaha, Nov. 9, 1895" (Rev. Bds. Neb., p. 30). From

the above records it appears certain that the Brant is an irregular or very casual migrant in Iowa.

Subfamily CYGNINÆ. Swans.

Two species of Swans are found in the state, during the migrations only. Both are large, heavy birds, pure white when in full plumage, and remarkable for the long, slender neck. Swans are chiefly vegetarian, but feed to some extent on small molluscs.

Genus OLOR Wagler.

64. (180). *Olor columbianus* (Ord). Whistling Swan.

Though the reports of observers are somewhat at variance on the question of abundance, the Whistling Swan appears to be much more common than the Trumpeter Swan in Iowa. It breeds in the far North, but passes regularly through Iowa both in the spring and fall, when its large size and striking appearance make it a conspicuous target for the gunners who take delight in slaughtering every unusual bird or mammal which passes within their notice. In this manner many species which are conspicuous either by reason of their large size or striking coloration, although not useful for food, have been practically exterminated or their numbers greatly reduced in localities where they were formerly abundant.

The Whistling Swan is an early migrant in spring. Thomas Say records *Anas* (*Cygnus* Meyer) *cygnus* at Engineers' Cantonment, "flying to the north, Feb. 22, 1820" (Long's Exp., i, 226–270). The usual time of migration is in March, but specimens have been taken the first week in April. In the fall they seldom appear before November.

County records: Boone—"arrive here usually in March; not nearly so plentiful as in former years. After becoming bewildered during a north-wester' they become an easy mark for the hunter and many are killed at such times throughout the county" (Henning). Hancock—mounted one shot on Lake Edwards, March 24, 1896 (Anderson). Jackson—"tolerably common transient; my last record is March 27, 1892, a specimen sent to me for mounting" (Giddings). Johnson—"specimens in University museum—a young female (gray plumage) shot three miles south of Iowa City, Nov. 15, 1902, by W. J. Kubichek; three seen; female,

Pleasant Valley, March 26, 1903, by Carl Spencer" (Anderson). Lee—"rare migrant" (Praeger). Linn—"rare migrant" (Berry). Pottawattamie—Mills—"rare migrant" (Trostler). Polk—"migrant" (Johnson). Poweshiek—"rare transient" (Kelsey, Jones). Washington—mounted two males shot near Brighton, Nov. 7, 1905 (Anderson). Webster—"transient" (Somes). Winnebago—saw one which was shot near Forest City, April 6th, 1894 (Anderson); "one shot near Leland by Rudolph Isaacs" (Halvorsen). Woodbury—"uncommon transient; I have the bird" (Rich). Harrison—"specimen in University museum, 5163, shot at Ball's Lake, near California Junction, by Wm. Olinger, April 5, 1886" (Anderson). There is also a specimen shot at Whiting, March 30, 1886.

The Whistling Swan may be distinguished by having a spot of yellow on the lores, and distance from eye to nostril greater than the distance from the nostril to the tip of the bill.

65. (181). *Olor buccinator* (Rich.). Trumpeter Swan.

At the present time the Trumpeter Swan is a rare bird in Iowa. During the early days the species undoubtedly nested in Iowa, though probably not commonly. A great many authorities have given the Trumpeter Swan as "breeding from Iowa northward," but there is little definiteness about the records. (Snow, Bds. of Kan., 1873, ii; Coues, Bds. of N. W., 1874, 544; Krider, Forty Yrs. Notes, 1879, 70; Ridgway, Cat. Aqu. and Fish-eating Bds., 1883, 19; Baird, Brewer and Ridgway, N. A. Bds., 1884, i, 430; Cooke, Bd. Migr. in Miss. Val., 1884–5, 79; Keyes and Williams, Bds. of Iowa, 1889, 119; Coues, Key to N. A. Bds., 1887, 682; A. O. U. Check List, 1886, 130; Goss, Bds. Kan., 1891, 108; Chapman, Bds. of East. N. A., 1903, 124; Bailey, Bds. of West. N. A., 1902, 70).

W. W. Cooke states: "Breeds from Iowa and Minnesota northward. It was reported breeding near Newton, Iowa, and at Heron Lake, Minn., as well as along the Red River of the North" (Bird Migr. in Miss. Val., 1884–5, 79).

The only definite record of the nesting of the Trumpeter Swan in Iowa which I have been able to trace was received from the veteran collector, J. W. Preston, in a letter dated March 22, 1904: "A pair of 'Trumpeters' reared a brood of young in a slough near

Little Twin Lakes, Hancock county, in the season of 1883, not many miles from where some good finds in the way of sets of Whooping Cranes were made. This was positively *Olor buccinator*. The nest was placed on a large tussock in a marshy slough or creek, and had been used for years by the swans, as I was credibly informed; but the nest mentioned above, so far as I am aware, was the last in that locality. During the earlier days the Trumpeter Swan was not an uncommon summer resident, being occasionally found nesting in some remote and hidden place, and as late as 1875 there were a few pairs known to breed on the headwaters of the Des Moines River. Of course the species of Swans have been somewhat confused in the minds of untrained observers, but to one familiar with the two American species there would be no chance of mistake. For many years I have not seen a Trumpeter Swan in the State."

County records: Blackhawk—"rare migrant; a specimen mounted by myself in museum of Iowa State Normal School" (Walters). Jackson—"tolerably common transient" (Giddings). Linn—"spring and fall migrant" (Bailey). Pottawattamie—Mills—"frequent migrant. I have seen the Trumpeters on the Missouri flying over from the Nebraska side of the river to the Iowa side, and in other directions, at numerous times. The following dates are noted by me in particular: April 5, 1893; Sept. 30, 1894; April 15, 1896; Sept, 20, 1897, and at various times since. *They were Trumpeters*" (Trostler). Poweshiek—"rare transient" (Kelsey). Sioux—"rare migrant" (Johnson). Webster—"migrant; from specimens actually in hand, and having no yellow at lores and having nostrils nearer eye than tip of bill" (Somes).

Order HERODIONES. Herons, Storks, Ibises, etc.

Sub-order IBIDES. Ibis series.

Family IBIDIDÆ. The Ibises.

The Ibises are long-necked, long-legged, and small-bodied birds, resembling Herons in habits. The bill is long, slender, and slightly curved, giving somewhat the appearance of a Curlew. They seek their food along the borders of lakes, bays, marshes, and mud flats.

Genus PLEGADIS Kaup.

66. (186). *Plegadis autumnalis* (Hasselq.). Glossy Ibis.

The Glossy Ibis is only a straggler into Iowa from the south. Kumlien and Hollister record it from Wisconsin as a "rare straggler, usually in late autumn [August, 1862, September, 1872, Lake Koshkonong; November 3, 1879, Lake Horicon]. We have positively seen this bird on the Mississippi near Prairie du Chien in August some twenty years ago." (Bds. Wis., 1903, 32–3.) "A specimen taken near Omaha, Bruner thinks at Cut-off Lake, is in the University museum" (Rev. Bds. Neb., 1904, 31).

County records: Boone—"Accidental visitor. Only one Ibis was ever taken in this county that I know of. It was identified as the Glossy Ibis, but may have been *Plegadis guarauna*" (Henning). Woodbury—Recorded from Sioux City by Dr. Guy C. Rich (Iowa Orn., i, 2, 1895, 49). In a letter he says: "I have an immature specimen mounted; shot in Nebraska just across the river, Oct. 1, 1893. It is an immature bird, *i. e.*, the head and neck are speckled; no white shows on forehead."

67. (187). *Plegadis guarauna* (Linn.). White-faced Glossy Ibis.

The White-faced Glossy Ibis is also a rare straggler in Iowa, from the southwestern United States. This species was first reported from Iowa by Prof. C. C. Nutting (Proc. Iowa Acad. Sci., 1892, 40), a specimen in the University museum, No. 4839, having been taken near Rippey (Calhoun county) in April, 1891, by B. F. Osborn, reported that there was a flock of thirteen near Rippey, but only one was secured.

At Heron Lake, Minn., a short distance north of the Iowa line, Rev. P. B. Peabody saw six Ibises in a rookery of Black-crowned Night Herons on the south side of the lake, June 26, 1894, and found two nests, one of four, the other of two eggs, on broken-down rushes. Two birds had been shot at Heron Lake in November, 1893 (reported by Dr. Roberts). Rev. Peabody learned from Iowa pot-hunters that two or three had been taken during each of the two autumns previous (Nidologist, ii, 9, 1895, 116-117). In 1895, Mr. Peabody reports: "June 22, I took at Heron Lake my third and fourth sets of White-faced Glossy Ibis, with

a magnificent male, the first mature bird of this species ever taken, to my knowledge, in the state of Minnesota" (Oölogist, xii, 8, 1895, 126).

"Two specimens recorded from Omaha by I. S. Trostler and L. Skow, one killed near Florence Lake, Aug. 19, 1893, and a second near Cut-off Lake, April 6, 1897" (Rev. Bds. Neb, 31).

Suborder HERODII.

Family ARDEIDÆ. Herons and Bitterns.

Subfamily BOTAURINÆ. Bitterns.

Two species of Bitterns are found in the state. As a rule they are solitary birds, frequenting grassy marshes. Their food consists principally of frogs, small fishes, tadpoles, etc., which are captured by striking with the sharp-pointed beak.

Genus BOTAURUS Stephens.

68. (190). *Botaurus lentiginosus* (Montag.). American Bittern.

The American Bittern is a common migrant in all parts of the state and considerable numbers remain during the summer wherever there are secluded marshes or sloughs. It cannot be considered as an abundant summer resident, for its habits are solitary, and usually not more than one or two pairs are found nesting in the same slough. The Bittern's peculiar note, sounding like the noise made by an old pump, or the strokes of a mallet upon a stake, has gained for it the popular colloquial names of "Thunder-pumper" and "Stake-driver." When suddenly startled at close range, the bird frequently remains standing perfectly motionless, with the long neck and bill pointed vertically upwards, in which position the broad longitudinal stripes on the neck blend with the surrounding reeds and rushes, and the bird becomes almost invisible.

The American Bittern is an early migrant, appearing as soon as the ice is fairly out of the marshes. It also remains quite late in the fall. I mounted a male bird shot by Louis Dennis near Cedar Rapids, Nov. 12, 1905. The stomach of a specimen shot near Forest City, Oct. 8, 1892, contained two whole frogs with their backs broken, and parts of several other frogs. When incubating, the female sits quite closely, frequently remaining on the

nest until taken off, trying to frighten away the intruder by erecting the feathers and thrusting with the strong, sharp bill. The nest is placed on low, damp ground near the edge of a slough or in the middle of a slough in a bed of rushes over the water. The eggs number four or five, brownish-drab in color, and sets are complete about the first of June in northern Iowa. The latest date I have is June 22, 1890, when I found a nest containing five eggs nearly ready to hatch in Winnebago county.

Genus ARDETTA Gray.

69. (191). *Ardetta exilis* (Gmel.). Least Bittern.

The Least Bittern, although from the reports of observers appearing to be generally distributed over the state, is not so common as the larger species. It is much more locally distributed and appears to be abundant at only a few points. The shy and retiring disposition of the species and the habit of keeping close cover in the matted jungles of reeds and rushes in large marshes may have much to do with its apparent rarity at many places. The Least Bittern may be found nesting in any part of the state where reedy swamps or sloughs exist.

On July 7, 1892, I took a set of five highly incubated eggs near Forest City, and June 16, 1894, found three nests containing five eggs each and one containing four eggs, in the bulrushes around the edge of a small lake in Hancock county. The nests were simply slight platforms of dry reeds placed several inches above the water in clumps of rushes.

The only locality where I have found the Least Bittern really abundant was in Dickinson county. During the early part of August, 1901, large numbers were seen in dense beds of reeds lining "The Narrows" between Spirit Lake and East Okoboji. They did not appear in flocks but every rod or two one would fly up, or climbing up a reed-stalk, would hang to it until the intruder came quite near. Both adults and fledged young birds were taken.

Dr. B. H. Bailey found them abundant at Clear Lake (Cerro Gordo) July 7-15, and at Eagle Lake (Hancock) July 17-20, 1902; also nesting commonly at Eagle Lake in June, 1903. The species is only tolerably common in Johnson county owing to the scarcity of sloughs. May 8, 1904, I saw eight birds in a small

slough near Iowa City, and a nest containing five young birds was found in the same slough by Harry Weber about a week later. E. S. Currier reports it as a very abundant summer resident in Lee county. Most other observers report the species as only fairly common.

Subfamily ARDEINÆ. Herons and Egrets.

The Herons form a large group, very similar to the Bitterns. As a rule they seek their food in more open situations than the Bitterns, wading in the water and frequently stalking their prey. Many of the species are gregarious and nest in large rookeries. Seven species have been recorded as captured in Iowa.

Genus ARDEA Linnæus.

70. (194). *Ardea herodias* Linn. Great Blue Heron.

The Great Blue Heron, popularly called "Blue Crane," is a tolerably common migrant in all parts of the state, and is frequently seen along the banks of wooded streams or lakes during the summer months. The Herons usually become more numerous after the middle of July, and during August and September are generally quite common. The species almost certainly nests in the state, but I have not been able to learn of any rookeries or, indeed, to find any nesting records of recent years. Keyes and Williams state that it "breeds in the vicinity of Spirit Lake and other parts of northern Iowa" (Birds of Iowa, 1889, 119). I observed large numbers around the shores and in trees on the banks of East Okoboji and Spirit Lakes in August, 1901, and they probably nest in that vicinity still. The Great Blue Heron feeds principally upon frogs and small fish, either standing motionless in shallow water and darting its long sharp bill at any prey which ventures too near, or stealthily advancing and surprising its luckless victim. The prey is bolted whole, and I have taken a common sucker at least ten inches long from the stomach of one killed on Lime Creek at Forest City.

The beautiful and graceful Great Blue Heron may well be taken as the typical form which calls to mind the quiet and solitude of our sluggish-flowing wooded streams during the sultry, heated days of summer.

Genus HERODIAS Boie.

71. (196). *Herodias egretta* (Gmelin). American Egret.

At the present time the American Egret can only be accounted a casual or irregular visitor in Iowa. The first Iowa record is that of Lewis and Clarke (Coues Hist. of L. and C. Exp., i, 73). "Aug. 11th, great numbers of herrons [herons, *Herodias egretta*] were observed today. [Near the present Badger Lake, Monona county, Iowa. Of the 'herrons,' Lewis' Ms. of Aug. 2d gives a long and good description.—E. Coues.]" The species is listed by J. A. Allen (White's Geol. of Iowa, ii, 426), and John Krider (Forty Years' Notes, 58) says: "I found this bird along the streams as far west as Iowa." W. W. Cooke (Bird Migr. in Miss. Val., 82-83) states: "The few which leave the vicinity of the vicinity of the sea-coast straggle up the Mississippi even to Minnesota. The greatest wanderers are the young, which, in the fall, often stray *northward* into regions where the species is not known to breed."

This species is one which has suffered greatly from the persecutions of plume-hunters, the trailing nuptial plumes or "aigrettes" being greatly prized. In Wisconsin, Kumlien and Hollister state: "so rare at the present time that three or four individuals only visit Lake Koshkonong each year where hundreds were found thirty years ago during August and September" (Bds. of Wis., 1903). "Four records from Nebraska. A specimen was killed near Omaha July 12, 1894, and reported by I. S. Trostler" (Rev. Bds. Neb., 33).

County records: Jackson—"have no late records; have formerly seen hundreds of them at a time on sand-bars in Mississippi River" (Giddings). Lee—"mounted specimens without dates often seen. They used to be common. One on April 6th my only date—Keokuk district" (Praeger); "I have only two records for this species; April 17, 1894, on Des Moines River, near Vincennes, Lee county; May 6, 1896, Des Moines River, near Bedford, Lee county" (Currier). Van Buren—"five years ago one was shot near Hillsboro" (W. J. Savage). Wayne—(A. J. Brown).

Genus EGRETTA Forster.

72. (197). *Egretta candidissima* (Gmelin). Snowy Heron.

The Snowy Heron, like the preceding, is only a casual visitor

in Iowa. The species is listed by J. A. Allen (White's Geol. of Iowa, ii, 426). Keyes and Williams report it as "very rare. Has been taken at Des Moines and in Floyd county in August" (Bds. of Iowa, 1889, 120).

County records: Blackhawk—"an uncertain late summer and fall migrant from the south; young birds wander northward probably as soon as fledged. Sometimes appears in considerable numbers in Blackhawk county. One spring visitor, probably accidental, recorded"(Peck). Lee—"rare; mounted specimens without dates often seen. A flock on August 29th is my only date—Keokuk district" (Praeger); "rare summer visitant. I think both the Snowy Heron and Little Blue Heron were present around Keokuk in August, 1891. I positively identified two young birds, male, shot" (Berry.)

Genus FLORIDA Baird.

73. (200). *Florida cærulea* (Linn.). Little Blue Heron.

The Little Blue Heron is also a casual visitor or straggler in Iowa. This species is remarkable for exhibiting dichromatism, adult being slaty- or grayish-blue, and immature birds pure white, or nearly so, sometimes mixed with bluish.

The species was listed by J. A. Allen (White's Geol. of Iowa, ii, 426), and Keyes and Williams (Bds. of Iowa, 1889, 120) report it as "rare; observed during the summer in the eastern part of the state." It was "observed by Trostler near Omaha June 15, 1897, and August 15, 1903. Bruner records a specimen from near Omaha years ago, brought to F. J. Breeze to be mounted, but whether killed in Iowa or Nebraska is not known. It has been reported as breeding north of Omaha on the Iowa side of the river, but this is probably an error. Possibly some of the records of the preceding species may have referred to the young of this species, since at that age it is white" (Rev. Bds. Neb., 33).

County records: Jackson—"common summer resident" (Giddings). Lee—"I think both Snowy Herons and Little Blue Herons were present around Keokuk in August, 1901. Although I did not shoot any Little Blue Herons, still I saw several birds that were in a mixed plumage and I could not place them anywhere else" (Berry). Linn—"last fall (1903) a white Heron was shot about five miles from Cedar Rapids, and from what I could

see of it, in a semi-putrid condition, I would call it a young Little Blue in the white phase" (Berry). Mills—Pottawattamie—"rare summer resident. Seen during summer, but no record of breeding (no nests seen)" (Trostler). Van Buren—"about fifteen years ago two were seen, and eight years ago one was seen in our locality—Hillsboro. They were dark (adults). Afterwards a farmer of reliability and some knowledge of birds told me he saw four little Cranes, three dark blue ones and one white with some blue feathers." (W. G. Savage). Webster—"rare; one killed in Aug., 1898, and one seen later in same month, about Aug. 27" (Somes).

Genus BUTORIDES Blythe.

74. (201). *Butorides virescens* (Linn.). Green Heron.

The Green Heron is the commonest and best known of all the Heron family found in the state. It is a solitary species, frequenting the shores of wooded streams and ponds, where it may often be seen dozing, with neck drawn back, on a dead limb or stub overhanging the water, or standing on one foot upon a mud-bank. When surprised it starts up with an alarming squawk, flying up-stream for a short distance, where it alights and gazes about with outstretched neck. It is generally common from about the middle of April until the last of September.

The Green Herons frequently nest in small colonies. Keyes and Williams say that they "usually nest in small colonies among the willows in swampy localities. Often a single pair is found nesting a mile or two from water, and, occasionally, also in evergreens" (Bds. of Iowa, 120). C. F. Henning tells of a heronry in a grove of maples in Boone county which the birds have used since 1888 (O. & O., xviii, 1893, 123). In Winnebago and Hancock I have only found the nests singly, and in wild crab-apple and plum thickets near streams; eggs laid about the last of May or first week of June. Practically every observer who reported gave the Green Heron as a common or abundant summer resident in Iowa.

Genus NYCTICORAX Stephens.

Subgenus NYCTICORAX Stephens.

75. (202). *Nycticorax nycticorax nævius* (Bodd.). Black-crowned Night Heron.

The Black-crowned Night Heron is reported by most observers

in the state as a rather rare summer resident. In southeastern Iowa the species appears to be less frequent. Walter G. Savage reports one specimen shot ten years ago, the only specimen captured in that locality (Hillsboro, Van Buren county). Praeger and Currier both report it as a rare visitant in Lee county (the Keokuk district), and Matson records one specimen at Mediapolis, Des Moines county.

Paul C. Woods describes a heronry near Spencer, Iowa, visited in June, 1895, in an oak thicket, "which must have extended 80 rods and hardly a tree that did not have one or two nests on it. The trees were rather small, and as they were very scraggly and inclined to sway, the nests were somewhat difficult to reach." (Iowa Orn., i, 2, 1895, 13). Dr. Trostler writes that the species is a "rare summer resident in Mills county. Dr. R. H. Wolcott, myself and party took a set of five eggs south of Manawa Lake, in Mills county, Iowa, May 15, 1904."

The Black-crowned Night Heron is a common summer resident in Winnebago and Hancock counties. I have observed great numbers at Rice Lake (Winnebago) in early June, and at Goose Lake (Hancock) the last week of May. Dr. B. H. Bailey found them "very common at Eagle Lake (Hancock), July 17–21, 1902, flying and squawking all night. No signs of a rookery. Known locally as "Lake Owls." In these localities the species is seldom seen along the streams in spring and early summer, but after the first of August birds in brown juvenile plumage are common, flying up from almost every bend in the streams. The species doubtless breeds at many points in the state, where it is found in summer, nesting either in trees or in reedy marshes. Great numbers breed annually at Heron Lake, Jackson county, Minn., making their nests in clumps of reeds.

Genus NYCTANASSA Stejnejer.

76. (203). *Nyctanassa violacea* (Linn.). Yellow-crowned Night Heron.

The Yellow-crowned Night Heron is a southern species, rarely venturing farther north than southern Illinois, and can only be accounted a rare straggler in Iowa. Audubon, in his "Journals," (ii, 481), under date of May 10, 1843, records two Yellow-crowned Night Herons near Council Bluffs. "One was killed at Omaha,

on the Iowa side of the Missouri River, May 1, 1892, and recorded by I. S. Trostler, who also reported one near Florence Lake Aug. 23, 1903" (Rev. Bds. Neb., 34). Other Iowa records are as follows:

Boone—"rare; only one record of its occurrence in the county. I have the specimen" (Henning). Jackson—"have a record of a specimen taken Sept. 15, 1892—Sabula" (Giddings). Sioux—"rare; one male—Hawarden" (Berry).

Order PALUDICOLÆ. Cranes, Rails, Coots, etc.

Suborder GRUES. Cranes,

Family GRUIDÆ. Cranes.

All three of the North American species of Cranes are found in Iowa. The Cranes are long-legged, long-necked wading birds, but have the front of the head sparsely covered with bristle-like feathers instead of being bare. The hind toe is short and elevated. They are omnivorous in diet, feeding on frogs, snakes, field-mice, and vegetable food. While the Cranes generally spend most of the time in marshes, they are also frequently found on uplands, cornfields, etc., particularly in spring and fall. They are gregarious during the migrating season and fly in long files, but become more solitary during the nesting season. Their voices are very loud and resonant.

Genus GRUS Pallas.

77. (204). *Grus americana* (Linn.). Whooping Crane.

It is highly probable that at the present time the Whooping Crane or White Crane can be accounted no more than a rare migrant in Iowa. This magnificent and striking bird, perhaps the most imposing species native to Iowa, was formerly a well-known and fairly common summer resident in the state, breeding in the large marshes which were at that time characteristic of northern Iowa.

Thomas Say mentions the arrival of the "Hooping Crane" at Engineers' Cantonment March 19, 1820 (Long's Exp., i, 266–270). T. M. Trippe states: "Quite a number seen in fall in Decatur county. Said to have been quite common formerly" (Pr. Bost. Soc., xv, 1872, 240). He also describes their migration in south-

ern Iowa, in company with the Sandhill Crane, Nov. 10–12, 1871, just prior to a severe storm (Am. Nat., v, 1873, 346). John Krider, in a letter to the editor of *Forest and Stream* (i, 15, 1873, 235), gives the species as very common at Lake Mills, Winnebago county; and in his "Forty Years' Notes" (1879, p. 57), he says: "This bird I found breeding in Winnebago county, Iowa, and was very shy and hard to approach. It flies in great numbers in autumn, toward the south." H. W. Parker also records the species from Tama county (Am. Nat., v, 1873, 169).

Dr. Coues says (Bds. of N. W., 1874, 530–1): "Its principal line of migration appears to be the Mississippi Valley at large. . . . a queried but probably correct set of eggs is in the [Smithsonian] collection from Dubuque, Iowa."

W. W. Cooke states (Bird Migr. in Miss. Val, 1884–5, 84–85): "In the spring of 1885 the Whooping Crane appeared at La Porte City, March 30; Emmetsburg, March 23; Heron Lake, Minn., March 31. It was common at Emmetsburg April 1; Heron Lake, April 3. It has been known to breed at Clear Lake, Iowa." N. S. Goss (Bds. of Kan., 132–3), says: "A set taken May 2nd, 1882, in Franklin county, Iowa, from a nest placed in a swale, and made of flags and rushes, a platform raised a little above the water, are in dimensions 4.01x2.60, 4.08x2.66." Keyes and Williams (Bds. of Iowa, 1889, 120) state that it is "not uncommon during migrations. Occasionally breeds in the northern part of the state."

J. W. Preston, in an article entitled "Some Prairie Birds" (O. & O., xviii, 6, 1893, 81), describes the nesting of the Whooping Crane along the headwaters of the Iowa River, south of Crystal Lake, in Hancock county, "years ago, when northwestern Iowa was a vast prairie, out into which few settlers had ventured and the monotony was seldom broken save by some wood-fringed lake or a herder's shanty." In early May, in the immense marsh lying north from Eagle Lake, he secured a number of eggs of the White Crane. "They had chosen the center of the marsh for a nesting-place, and there, a mile from the higher shores, the mother birds could be seen upon the nests, which were formed of grass gathered together in a firm heap about one and one-half feet high, and placed on firm sod, out of water, but very near it. In the top of this heap was a very slight depression for the eggs."

The writer explored the same locality on May 26, 1894 (Oölo-

gist, ix, 8, 1894; Davies Nests and Eggs of N. A. Bds., 5th ed., p. 120), having been told by a farmer's boy that a pair of White Cranes were frequenting a large marsh. A number had been seen in the locality early in the spring, but only one pair had remained. As we came over a low ridge on one side of the marsh, two great white birds rose up several hundred yards away, and flew with slow, heavy flaps to the further side, where they stalked along with stately strides as fast as a man could walk. Occasionally one would utter a loud, ringing, resonant "whoop," that could be heard for a long distance. Near one end of the slough, in a small branch or inlet, several old Crane's nests, or muskrat houses, were found only a few rods apart. On one of these were two large greenish-brown eggs, spotted quite thickly over the whole surface with brown and buff spots and purplish shell markings. Both eggs were perfectly fresh and measured 4.06x2.38 and 4.03x2.50. The nest was a mass of grass, rushes and reeds, about two feet across and rose eight or ten inches above the water, which was about eighteen inches deep. The nest was so solidly built that I sat down on it without sinking it into the water. The water was open for a few feet around the nest, but in most places was grown up with rushes and sawgrass. The two Cranes stalked along the hill-side some distance away, keeping close together and apparently trying to divert our attention by holding their heads down, dragging one leg, or spreading their wings. They finally approached within about twenty rods and would stand perfectly still for a minute at a time, with the wings wide-spread and held out from the body, making a beautiful picture with their graceful snowy-white bodies and great black-tipped wings. On our moving towards them, they flew a short distance and alighted again, but defied closer approach.

This was the first and last nest which has come under my observation, though I visited the locality several times. On May 15, 1897, I saw one White Crane circling overhead near this vicinity, and on June 5, 1897, was told by several different farmers near here that a pair had remained all spring and been seen always within a half a mile of the same place. Two boys said they had seen the cranes that very day. Since then the Whooping Crane seems to have disappeared from Winnebago and Hancock, except as a rare migrant, and, with the recent extensive

county ditches and reclamation of marsh land in that part of the state, it is extremely doubtful whether the species will ever nest again in Iowa.

County records: Blackhawk—"scarce migrant" (Peck). Polk—"rare" (Johnson. Pottawattamie-Mills—"rare migrant" (Trostler). Poweshiek—"rare transient" (Kelsey). Sioux—"migrant" (Johnson); "rare summer resident, near Hawarden, in 1890" (Berry). Warren—"rare; of late years the cranes have become rare in this vicinity" (Jeffrey). Wayne—(Brown). Woodbury—"rare transient; usually passes here so high in the air that you can search often before seeing them" (Rich).

78. (205). *Grus canadensis* (Linn.). Little Brown Crane.

The Little Brown Crane or Northern Brown Crane is supposed to be confined in the breeding season to Arctic and northern North America, migrating through the western United States. Its plumage is substantially the same as that of the Sandhill Crane, but the bird is distinguishable by its smaller size. Coues gives the average measurements: Length 36; wing 18-19; tail 7; bill 3-4; tibia bare for about three inches.

The University museum has several Iowa specimens averaging as small as this. One specimen, No. 6258, was sent to Robert Ridgway, who identified it as *G. canadensis:* female; Holly Springs, Iowa, April 8, 1887; D. H. Talbot Coll. L. 34.50; E. 68; W. 16.75; T. 6.80; B. 3.72; Ts. 5.50; Tb.(bare portion) 2.30.

Seventeen other specimens in the Talbot collection from western Iowa come well within the limits of *canadensis* as given by Coues' Key and Ridgway's Manual. Nos. 5205, 5215, 5222, 5364,6251,6256,6261, all taken near Holly Springs, April 8, 1887; 5206, Whiting, April 12, 1887; 5206 and 5213, Whiting, April 12, 1886; 5199, Holly Springs, April 18, 1887; 5209, Sloan, April 28, 1884; 5217, Sloan, April, 1884; 5365, Whiting, April 6, 1886; 6252, Whiting, April 9, 1886; 5402 and 6255, Sloan (no date).

Wm. E. Praeger writes that he has "one record; shot April 10, 1896, in Missouri, just across the Des Moines River—Keokuk district;" also reported as a "rare migrant in Lee county" (Currier); and as a "rare migrant in Kossuth" (Bingaman).

Kumlien and Hollister record two positive specimens from Wisconsin (Bds. of Wis., 37). "L. Skow has reported it from Omaha; very rare migrant" (Rev. Bds. Neb., 34).

It is probable that the Little Brown Crane occurs as a migrant in Iowa rather more commonly than has been supposed, its close resemblance to the Sandhill Crane making their confusion easy.

79. (206). *Grus mexicana* (Müll.). Sandhill Crane.

The Sandhill Crane or Brown Crane is the commonest Crane in Iowa. It formerly nested quite commonly in the marshes of northern Iowa, where a few pairs still breed, and is still fairly common on the prairies as a migrant, though much less abundant than before. Fifteen years ago flocks of hundreds, or even thousands, were frequently seen trooping over cornfields and plowed ground in the early spring in Winnebago and Hancock counties. In the spring large flocks frequently perform graceful aërial evolutions high over their feeding grounds, each bird soaring in an ever ascending spiral until the birds are almost lost to view at a great height, and only the faint echo of their loud, discordant cries comes to the ear.

Thomas Say (Long's Exp., i, 266–270) noted the species in Pottawattamie county and at Engineers' Cantonment, arriving March 24, 1820; and Edwin James (ibid, ii, 67–68) noted large numbers April 13, 1820, along Boyer Creek, Pottawattamie county, referring to their habit of removing the surface of the soil by scratching with their feet in search of the radical tubers of the pea-vine, which seem to afford them a very palatable food.

J. A. Allen (Mem. Bost. Soc., i, 1868, 501) states: "Saw several in August stalking about on an uninhabited prairie, and often in September, flying over at great heights. Said to breed abundantly in the marshes of the Skunk River country, near the middle of the state." T. M. Trippe (Am. Nat., 1873, 346) describes the migration of vast flocks in southern Iowa Nov. 10–12, 1872, just prior to a storm; both species noted; also (Pr. Bost. Soc., xv, 1872, 740) "said to have bred in the marshes before the settlement of the country" [Decatur and Mahaska]. John Krider (Forty Years' Notes, 1879, 57) says: "I found them very plenty in Iowa, breeding in May. I found the eggs late in June and hatched them under a hen. . . . I have found the young upon the prairies, only one at a time, and not far distant I would find the other, and if put together they would fight." J. W. Preston, (O. & O., xviii, 1893, 81) describes the taking of several sets of

eggs, at an early day, in Hancock county. "Their nests being uniformly in the water, formed by tramping rush stalks down until the pile reached the surface, these nests often float about with the mother birds upon them."

On May 24, 1894, I purchased two eggs of the Sandhill Crane from a boy who had taken them one week previously in a marsh along the headwaters of the Iowa River, northwest of Hayfield, Hancock county. He showed me the nest (apparently an old muskrat house) in a narrow, reedy slough between two low, gravelly hills. We saw several Cranes in the vicinity but they were very wary, and we could locate no more nests. The eggs were slightly incubated, lacked the greenish tint observed in a set of Whooping Cranes, and the shells had a much smoother surface. I have not visited this locality for several years and do not know whether any Cranes are still nesting there.

G. H. Berry noted the Sandhill Crane as a rare summer resident near Hawarden, Sioux county, in 1890. Nearly all the later observers report the species present, but only as a migrant. The only differing report came from W. H. Bingaman, who reported it as a "rare breeder" in Kossuth county (1905).

The University museum has several specimens from various Iowa points which measure up to the average of *G. mexicana* as given by Coues, viz.: Length 40–48; wing 22; bill 5–6; tail 9.

Suborder RALLI. Rails, Gallinules, and Coots.

Family RALLIDÆ. Rails, Gallinules, and Coots.

This is a large family of marsh-inhabiting birds, generally with the body narrow and compressed and the legs strong, enabling them to make their way with ease through dense, reedy marshes. Their food consists of both animal and vegetable matter, picked up from the surface of the ground or water.

Subfamily RALLINÆ. Rails.

Family RALLUS Linnæus.

80. (208). *Rallus elegans* Aud. King Rail.

The King Rail or Fresh-water Marsh Hen is a tolerably common summer resident in nearly all parts of the state and breeds wherever suitable sloughs and marshes are found. The species is retiring in its habits, hiding in the thick clumps of sedges, and is rarely seen unless its favorite haunts are penetrated for this

express purpose. The nest is usually placed near the bottom of a clump of rushes or sedges, generally over water, and contains nine to twelve eggs, deposited about the last of May.

County records: "Rare summer resident"—Boone (Henning); Franklin (Shoemaker); Mills—Pottawattamie (Trostler); Van Buren (Savage); Winneshiek (Smith); Blackhawk (Peck).

"Common summer resident"—Hardin (Peck); Lee (Praeger, Currier); Linn (Bailey, Berry); Polk (Johnson); Kossuth (Bingaman); Winnebago (Anderson, Halvorsen).

"Transient"—Jackson (Giddinger); Poweshiek (Kelsey); Scott ("Rare; one shot April 30, 1891"—Wilson).

81. (212). *Rallus virginianus* Linn. Virginia Rail.

The Virginia Rail in appearance and habits is an almost perfect miniature of the King Rail. Observers in all parts of the state agree in considering the species as a somewhat rare and uncommon summer resident. A few report it as common during migration. W. H. Bingaman gives it as a "common breeder" in Kossuth county. In Winnebago and Hancock counties I have found it tolerably common in summer. While seen less frequently than the King Rail, probably on acconnt of its smaller size, I have found more nests than of those of the latter species. Nests are composed of dried grasses and reeds, forming a small platform near the bottom of a clump of sedges. June 5, 1895, took seven fresh eggs from a nest which contained six on June 1 (Winnebago); June 6, 1894, nine eggs, slightly incubated (Hancock); June 23, 1894, caught downy young bird, color dark green, almost black; June 3, 1897, six eggs; June 10, 1897, nine eggs, incubation begun (Winnebago).

Genus PORZANA Vieillot.

Subgenus PORZANA Vieillot.

82. (213). *Porzana carolina* (Linn.). Sora.

The Sora or Carolina Rail is reported by observers in nearly all parts of the state as a common or abundant migrant. It does not appear to nest commonly south of the central line of the state, but in northern Iowa it breeds abundantly. A. I. Johnson reports the Sora as a common summer resident and nesting in Polk county. A few nest in Johnson county, and E. S. Currier reports

it as a "very abundant migrant and rare summer resident in Lee county."

In Winnebago and Hancock counties the Sora is particularly abundant, there being scarcely a sedge-grown slough which does not harbor several pairs during the breeding season. In early May I have found the Soras so tame that they could hardly be made to fly by wading after them as they tried to hide in the thin grass, with short, stubby tails bobbing nervously as they walked, and standing erect when they stood still.

J. Eugene Law took twenty-seven sets of the Sora near Lake Mills (Winnebago) in the spring of 1893. June 7, 1892, I found about a dozen nests, containing from three to eleven eggs, all placed in clumps of saw-grass around the edge of a slough, about where the water-line began, outside of the area of rushes and reeds, Sometimes the nest is placed in shallow water. It is built by piling up short bits of rushes or cat-tail leaves until a dry platform is formed. Nests are frequently found with eggs in all stages of incubation, from fresh eggs to those nearly ready to hatch. Seventeen eggs is the largest number I have found in a single nest. May 30, 1893, I found about a dozen nests containing from one to nine eggs. June 22, 1894, caught a young Sora, just hatched, and covered with jet-black down.

During the nesting season the Soras are very noisy, particularly towards evening, and frequently at night, making the marshes resound with their weird and piercing notes.

Subgenus COTURNICOPS Bonaparte.

83. (215). *Porzana noveboracensis* (Gmel.). Yellow Rail.

The Yellow Rail or Crake is a rare species, occurring in summer. Its small size and secretive habits doubtless prevent its being observed more frequently. The species was listed by J. A. Allen (White's Geol. of Iowa, ii, 426), and John Krider states that "it breeds in Iowa, where I found its nest with eight eggs" (Forty Years' Notes, 69). Keyes and Williams give it as an occasional in Iowa, frequenting the prairie sloughs (Birds of Iowa, 1889, 121).

County records: Blackhawk—"has been taken once in Blackhawk county. The bird never seems to take flight when pursued, but may be captured with the hands" (Peck). Dickinson—

"noted from Lake Park in fall of 1895" (Salisbury). Johnson—"one specimen secured near Iowa City, Mus. No. 8948, female, May 27, 1892, Vogt's Swamp, by F. Carroll (Proc. Iowa Acad. Sci., 1892, 41)." Lee—"rare migrant in spring" (Praeger); migrant, but very irregular in numbers and occurrence" (Currier). Linn—"rare migrant; occasional summer resident" (Berry). Scott—"rare migrant; one shot Sept. 20, 1890" (Wilson). A male and female in the Bartsch collection were shot Sept. 9, 1898, in Henderson county, Ill., (across the river from Burlington, Iowa).

Subgenus CRECISCUS Cabanis.

84. (216). *Porzana jamaicensis* (Gmel.). Black Rail.

The Black Rail appears to be even rarer than the preceding species, its range not extending so far to the north. Its habits are similar.

County records: Blackhawk—"rare migrant; one specimen mounted" (Walters). Des Moines—"Burlington, Iowa, 1892—specimen in the flesh examined by me" (Nutting, Proc. Iowa Acad. Sci., 1892, 41). Lee—"very rare—Keokuk district" (Praeger). Linn—"a set of eggs was found by myself in 1899, too far incubated to save" (Berry). Van Buren—"some 17 or 18 years ago a farmer caught one with his hands while plowing in a swamp and brought it to me. This is the only time that I have known it to occur here—Hillsboro" (W. J. Savage). Webster—"rare; July 11, 1899, killed a small rail of some sort new to me, along the edge of the slough in Black's field just east of the rendering works (Fort Dodge). It is 5½ inches in length; dark slate on head and breast, back dark brown tinging to a reddish at back of neck" (Somes).

Subfamily GALLINULINÆ. Gallinules.

Genus IONORNIS Reichenbach.

85. (218). *Ionornis martinica* (Linn.). Purple Gallinule.

This brilliant southern species is only an accidental visitor in Iowa. It is listed by J. A. Allen (White's Geol. of Iowa, ii, 1870, 426), and John Krider states that he found it breeding in Iowa (Forty Years' Notes, 60). Morton E. Peck reports: "One specimen from Blackhawk county, an estray from the south."

Kumlien and Hollister consider it as an exceedingly rare straggler in Wisconsin; recorded from Racine, Milwaukee, and Janesville (Birds of Wis., 93). It has been recorded once from Nebraska—seen by Prof. Bruner at West Point, in June or July, 1894 or 1895 (Rev. Bds. Neb., 36).

Genus GALLINULA Brisson.

86. (219). *Gallinula galeata* (Licht.). Florida Gallinule.

The Florida Gallinule or Red-billed Mud-hen is generally distributed throughout the state and breeds in suitable localities, but can hardly be considered common. It ranges as far north as central Minnesota, breeding along the Minnesota river bottoms (Hatch, Geol. and Nat. Hist. Minn., 1880, p. 460), and commonly at Heron Lake, Minn. (Peabody, Oöl., xii, 1, 1895, 15). P. C. Woods reports collecting a set of fifteen eggs there in 1896 (Iowa Orn., ii, 4, 1896, p. 86).

County records: Blackhawk—"apparently a regular visitor to the state but rare. A set of eggs was taken many years ago in Blackhawk county by George D. Peck, when it was found breeding in company with Coots" (M. E. Peck); "rare migrant" (Walters). Hancock—"shot male July 18, 1902, at Eagle Lake" (Bailey). Linn—"rare summer resident" (Bailey, Berry); "hardly common, though it has several times been found breeding in this vicinity, in situations similar to *Rallus elegans*" (Keyes). Lee—"scarce summer resident; breeds in Keokuk district" (Praeger); "summer resident, not common" (Currier). Poweshiek—"rare summer resident" (Kelsey). Pottawattamie-Mills—"abundant migrant; used to breed in considerable numbers in both counties, but none found nesting since 1898" (Trostler). Woodbury—"uncommon transient" (Rich). Winnebago—"rare summer resident; took a set of ten eggs at Forest City, June 4, 1897, and shot two birds at Rice Lake, Sept. 10, 1903" (Anderson).

Subfamily FULICINÆ. Coots.

Genus FULICA Linnæus.

87. (221). *Fulica americana* (Gmel.). American Coot.

The American Coot, Common Coot, or "Mud-hen," is one of the best known representatives of the family in the state. It is readily recognized, even at a distance, by its slaty-black plumage

and white bill, and most young sportsmen have killed specimens, taking them for ducks. Coots are good swimmers and are usually found on the lakes or reedy marshes containing much open water, though they are often found on rivers during migration. When sufficiently alarmed to fly up the bird usually patters along the surface of the water for some distance, with a noisy splashing, before rising up.

The American Coot breeds in suitable localities throughout the state, but more commonly in the northern portions. Both Currier and Praeger give it as a scarce summer resident in Lee county (Keokuk). Dr. Trostler reports it as "an abundant migrant in Pottawattamie and Mills; used to breed in considerable numbers in both counties, but none found nesting since 1898." Blackhawk—"formerly a not rare breeder in Blackhawk, but now almost unknown except during migrations" (Peck). Boone—"fairly common summer resident" (Henning). Franklin—"summer resident, not common" (Shoemaker).

In Winnebago and Hancock counties the species is an abundant summer resident, nesting in every slough which contains open water. The nests consist of platforms of dead reeds placed in clumps of cat-tails or reeds surrounded or reached by avenues of open water. The eggs are eight to fourteen in number, light clay-colored or creamy, thickly specked over the entire surface with pin-points of black, and are laid from the middle of May until the early part of June. While usually not considered a game bird, the Coot is accounted excellent eating by many sportsmen, equal to the flesh of most ducks.

Order LIMICOLÆ. Shore Birds.

Family PHALAROPODIDÆ. Phalaropes.

This is a small family of three species, resembling Sandpipers, but distinguished by having lobate feet. The under plumage is duck-like, and the birds swim well.

Genus CRYMOPHILUS Vieillot.

88. (222). *Crymophilus fulicarius* (Linn.). Red Phalarope.

The Red Phalarope "breeds in the far north, coming south in winter to the northern half of the Mississippi Valley. Has been recorded from Illinois (Nelson) and from Minnesota (Hatch)"

(Cooke, Bird Migr. in Miss. Val., 1884–85, p. 89). The species is listed by J. A. Allen (White's Geol. of Iowa, 1870, 426). G. H. Berry reports it as a "rare migrant" at Hawarden, Sioux county.

Kumlien and Hollister state: "Small flocks may be met on Lake Michigan and Lake Superior in autumn, and occasionally straggling individuals wander to the inland lakes . . . four on Lake Koshkonong, September 3, 1891, one June 4, 1877" (Bds. of Wis., 1903, 41).

Genus PHALAROPUS Brisson.

Subgenus PHALAROPUS Brisson.

89. (223). *Phalaropus lobatus* (Linn.). Northern Phalarope.

This species is also a far northern bird and is a rare migrant through the Mississippi Valley. Kumlien and Hollister report it as much more common than the Red Phalarope in Wisconsin; noted on Lakes Michigan and Superior in September and October, and a regular spring and fall migrant on Lake Koshkonong (Birds of Wis., 1903, 41). "Reported from Omaha by I. S. Trostler, where a specimen was taken May 6, 1896" (Rev. Bds. Neb., 1904, 37).

A specimen in the University museum, No. 16525, was taken at Burlington, Iowa, Aug. 10, 1894, by Paul Bartsch. Dr. Trostler also reports the species as a rare migrant on the Missouri River, in Pottawattamie county.

Genus STEGANOPUS Vieillot.

Subgenus STEGANOPUS Vieillot.

90. (224). *Steganopus tricolor* (Vieillot). Wilson Phalarope.

The Wilson Phalarope, probably the most beautiful and dainty of all the shore birds found in Iowa, appears to be somewhat locally distributed, breeding only in the northern part of the state. The species is remarkable, like the other Phalaropes, for the female being larger and much brighter colored than the male. Following out the general rule of protective coloration, the duller-colored sex appears to assume most of the duties of incubation. I have several times, at least, flushed the male Phalarope from the nest of eggs, both in Iowa and in North Dakota, while I have never seen the female leave the nest, although she is usually found in the vicinity.

In Winnebago and Hancock counties the Wilson Phalarope is a common summer resident on the larger marshes, particularly on peat beds around their margins, where the ground is spongy and saturated with water. As these are usually burned over in the fall, the grass is short in the spring, and the nest is simply composed of a few straws placed in a little hollow of a peaty hummock, scarcely concealed by the straggling green sprigs of grass. The eggs are four in number, distinctly pyriform in shape, much resembling the eggs of the Spotted Sandpiper, and always arranged with the points together. While in the vicinity of the nesting place, all of the Phalaropes in the neighborhood, often more than a dozen, will hover over the intruder's head, ruffling out the feathers of the neck and uttering a peculiarly gentle, crooning note, apparently trying to draw him away. They frequently swim on ponds, like small ducks, and often one will be seen whirling giddily round and round in the water as if on a pivot, seemingly engaged in capturing small water bugs.

The eggs are usually laid about the 20th of May in northern Iowa. I took a set of four eggs June 2, 1894, in a slough near Leland (Winnebago), which was advanced in incubation; and May 13, 1893, removed an egg, fully developed but lacking the pigment spots, from the oviduct of a female shot in Hancock county. June 11, 1892, caught a downy young specimen, light-colored, with black stripes on hind neck and rump. This species is practically confined to the interior of North America, while the other two Phalaropes are found principally on the coasts.

Family RECURVIROSTRIDÆ. Avocets and Stilts.

This is a small family characterized by extremely long and slender legs and long slender bill; feet either fully or partially webbed. They feed in shallow water, swimming when necessary.

Genus RECURVIROSTRA Linnæus.

91. (225). *Recurvirostra americana* Gmel. American Avocet.

The American Avocet or "Blue-stocking" is a species of striking appearance, known at once by its contrasting colors, long recurved bill, and blue shanks. It is only rarely found in Iowa, being more abundant in the West. Thomas Say observed the species at Engineers' Cantonment, February 20, 1820 (Long's Exp., i, 266–270).

County records: Dickinson—"Lake Park, fall of 1890" (Salisbury). Johnson—"mounted a female for University museum, shot on Iowa River near Butler's Landing, north of Iowa City, April 22, 1902" (Anderson). Lee—"accidental; one record, Keokuk district" (Praeger); "rare visitant" (Currier). Pottawattamie-Mills—"common migrant" (Trostler). Sioux—"June 2, 1900, I collected a set of four eggs of the American Avocet but was unable to blow them as they were too far advanced. I saw two or three pairs of the birds; locality, prairie, about three miles east of Hawarden" (Berry). Woodbury—"rare transient" (Rich).

Genus HIMANTOPUS Brisson.

91. (226). *Himantopus mexicanus* (Müll.). Black-necked Stilt.

This is a species of tropical America, only rarely venturing up the Mississippi Valley as far north as Iowa. It is listed by Allen (White's Geol. of Iowa, ii, 1870, 426). "Has only been observed in Nebraska in the vicinity of Omaha, from where L. Skow and I. S. Trostler record it, the latter giving the following dates: May 18, 1893; May 6, 1894; April 10, 1895, and October 3 and 9, 1894" (Rev. Bds. Neb., 37).

County records: Mills-Pottawattamie—"scarce migrant" (Trostler). Sioux—"shot one female at Hawarden in 1890" (Berry). Webster—"several were killed here in summer of 1898" —Fort Dodge (Somes). Wayne—(Brown). Woodbury—"rare transient—Sioux City" (Rich).

Family SCOLOPACIDÆ. Snipes, Sandpipers.

This is a large family, including about forty-five North American species. They are usually gregarious during migrations and are found in large flocks, generally along the shores of bays, lakes, ponds or rivers, where they pick up their food from the mud and ooze. They are rarely found far from water and, with the Plovers, are known collectively as Shore Birds or Bay Birds.

Subfamily SCOLOPACINÆ. Snipe.

Genus PHILOHELA Gray.

93. (228). *Philohela minor* (Gmel.). American Woodcock.

The American Woodcock, although quite well known, appears to be nowhere a common bird in the state. In the spring its pref-

erence seems to be for low thickets in bottom lands; in late summer it is frequently found in cornfields near woods, and in autumn is often found on wooded hillsides. Its presence in a locality may always be detected by its "borings" in soft, damp ground, where the long bill has been probed for earthworms.

Formerly the species was much more common in the state. J. A. Allen reported it as common in western Iowa (Mem. Bost. Soc., i, 1868, 501); and F. V. Hayden as "not uncommon near Council Bluffs" (Trans. Am. Philos. Soc., xii, 1863, 174). Morton E. Peck says it was "once a common migrant in most wooded localities; now quite scarce. Bred frequently in Blackhawk county twenty years ago, where on April evenings in low woods the peculiar nesting call was no uncommon sound." In Winnebago county the species is also much less common than formerly. At the present time all observers who reported consider the Woodcock as a rare summer resident in Iowa.

Genus GALLINAGO Leach.

94. (230). *Gallinago delicata* (Ord). Wilson Snipe.

The Wilson Snipe, the popular "Jack-snipe" of nearly all gunners, is an abundant migrant in almost all parts of the state, being most common in April. It frequents the edges of marshes and water-soaked meadows, where it probes with its long, sensitive bill in the soft ground for its food. When flushed the bird springs up into the air in a swift, tortuous spiral, uttering a hoarse "scape" and forming a very difficult target until, poising for a moment in mid-air, it dashes away in a straight course.

The Wilson Snipe generally breeds farther north than the Iowa line, returning in September, remaining through October, and frequently tarrying until late in November around some springy run. In such localities the species has been known to remain until midwinter, even in Minnesota (Roberts) and Wisconsin (Kumlien and Hollister). I have seen the bird in Winnebago county as early as August 11 (1894), and flushed one specimen from a springy bog in Ellington township, Hancock county, in midwinter.

John Krider states that he "found it breeding in Iowa" (Forty Years' Notes, 1879, p. 63), but the only recent record is that of W. H. Bingaman, who reports: "One set taken in Union Slough

(Kossuth county), May 3, 1901, the only pair that I think ever nested around here."

Subfamily TRINGINÆ. Sandpipers.
Genus MACRORHAMPHUS Leach.

95. (231). *Macrorhamphus griseus* (Gmel.). Dowitcher.

The Dowitcher or Red-breasted Snipe is a not very common migrant in Iowa. It was listed by Allen (White's Geol. of Iowa, ii, 1870, 425). Trippe reported it as "not common; seen in spring only"—Decatur and Mahaska (Pr. Bost. Soc., xv, 1872, 241), and Parker from "Clinton county" (Am. Nat., v, 1871, 169). Keyes and Williams give the species as "not uncommon during the migratory period" (Bds. of Iowa, 1899, 122). Peabody reported it from Heron Lake, Minn., fall of 1894 (Oöl., xii, 1, 1895).

County records: Des Moines—"two specimens in the Univerity museum, taken at Burlington by Paul Bartsch: No. 16290, Aug. 6, 1893; No. 16291, Aug. 16, 1893. Lee—"rare—Keokuk district" (Praeger). Polk—"common" (Johnson). Pottawattamie—"rare migrant" (Trostler). Sioux—"rare" (Johnson). Woodbury—"uncommon transient; Sioux City" (Rich).

96. (232). *Macrorhamphus scolopaceus* (Say). Long-billed Dowitcher.

This species is very much like the last but is more highly colored and averages larger. It is generally regarded as having a more western range, but both varieties are known to occur at large over the whole of North America. It is interesting to Iowa ornithologists to know that the species was originally described by Thomas Say as *Limosa scolopacea*, from several specimens shot in a pond near the "Bowyer Creek," Pottawattamie county, Iowa (Long's Exp., 1819–20, i. Notes, p. 335).

Kumlien and Hollister state that formerly both *griseus* and *scolopaceus* were very common, 1865–1875, during May, June, July, August and September (less in July), but *very* few bred. In Wisconsin, at the present time, they are known only during migrations and then sparingly (Birds of Wis., 1903, 44). John Krider noted: "Arrives in Iowa about the first of June, feeding on the burnt prairies" (Forty Years' Notes, 1879, 64). G. H. Berry noted the species as a "rare summer resident" at Hawarden, Sioux county, in 1890.

Genus MICROPALAMA Baird.

97. (233). *Micropalama himantopus* (Bonap.). Stilt Sandpiper.

The Stilt Sandpiper has only been recorded from a few localities in Iowa and seems to be somewhat irregular in its occurrence. It is listed by Allen (White's Geol. of Iowa, 1870, 425). Keyes and Williams state that they observed it but once, "in early autumn on the open prairie in Floyd county. There were four individuals wading about in a small pond; a single specimen only was secured" (Bds. of Iowa, 1889, 122). P. B. Peabody saw four or five and shot one at Heron Lake, Minn., May 19, 1894 (Oöl., xii, 1, 1895).

County records: Allamakee—"shot one Aug. 10, 1904, at Lansing" (Bailey). Des Moines — Museum No. 16504, shot at Burlington Sept. 28, 1889, by Paul Bartsch. Mills–Pottawattamie—"common migrant" (Trostler). Winneshiek—"I shot a bird of this species Aug. 26, 1896, the only record of its occurrence here" (Smith).

Genus ACTODROMAS Kaup.

98. (239). *Actodromas maculata* (Vieillot). Pectoral Sandpiper.

The Pectoral Sandpiper, Grass Snipe, or Jack-snipe, commonly known to Iowa hunters as the "Prairie Pigeon," is an abundant migrant in nearly all parts of the state. This species is seldom found along beaches, preferring wet, grassy meadows or muddy flats, and frequently feeding on higher grounds, usually in small, compact flocks. The Pectoral Sandpipers often arrive in Iowa early in April and remain until late in May. They pass north to breed, but return very early, usually by the first week in August. I shot two in Winnebago county July 27, 1904, and saw a large flock at Dubuque, July 27, 1901. A flock of about forty was seen in an upland pasture August 6, 1901, and three shot (Winnebago). Dr. C. C. Smith reports that he has seen it "as early as March 29 and as late as October 31, in Winneshiek; rather rare since the spring of 1895." During the fall migration the birds are usually very heavy and fat, so that the skin of the breast often breaks as the bird drops to the ground when shot.

99. (240). *Actodromas fuscicollis* (Vieillot). Bonaparte Sandpiper.

This species was reported from Iowa by only a few observers. Thomas Say (Long's Exp., 1819–20, i, 337) describes a specimen

of *Pelidna cinclus*, saying: "This bird was shot in November near Engineers' Cantonment and is probably a variety of the very variable *Cinclus* in its winter plumage." Keyes and Williams give it as a "rather common migrant, appearing the last of March about the quiet pools near the watercourses." (Bds. of Iowa, 1889, 122).

County records: Dickinson—"rare migrant; Spirit Lake" (Berry). Lee—"migrant, very abundant" (Currier). Polk—"noticed at Des Moines March 31, 1884" (Cooke, Bird Migr. in Miss. Val., 1884–5, 93). Pottawattamie—"rare migrant" (Trostler). Poweshiek—"tolerably common transient" (Kelsey). Woodbury—"transient, Sioux City" (Rich).

100. (241). *Actodromas bairdii* Coues. Baird Sandpiper.

The Baird Sandpiper is a species of the interior of North America, breeding in the Arctic regions, and migrating through the Mississippi Valley; rare on both coasts.

County records: Des Moines—two specimens in the University museum were taken at Burlington Oct. 2, 1895, by Paul Bartsch. Johnson—"two specimens killed near Iowa City last spring, now in University museum" (Nutting, Proc. Iowa Acad. Sci., 1892, 41). Lee—"common migrant, Keokuk District" (Praeger). Linn—"spring and fall migrant" (Bailey). Mills–Pottawatamie—"common migrant" (Trostler). Webster—"rare; two specimens" (Somes). Woodbury—a specimen shot by C. Brown on Brown's Lake, near Sioux City, was sent me by Dr. G. C. Rich for identification.

101. (242). *Actodromas minutilla* (Vieillot). Least Sandpiper.

The Least Sandpiper or Peep, the smallest member of the family, is an abundant migrant in Iowa, being found everywhere along the muddy shores of ponds or streams. The spring migration is generally confined to the month of May, but the autumnal migration is more prolonged. I have shot specimens on July 31, 1893, and July 28, 1894, and numbers in the first half of August. They are frequently seen in company with other species and are frequently confounded with *Ereunetes pusillus*, but may be readily identified by having the toes cleft to their bases.

All observers but one report the species as migrant only. Chas. R. Keyes gives it as a rare summer resident in Linn county and

says that the late Joseph Brown of Norway, Iowa, had a breeding record for Benton county. Mr. Brown's daughter, Miss Nina Brown, writes: "My father has in his collection a set of four Least Sandpiper eggs of his own taking. There is no date with them and his book of field notes is lost, so the exact date and locality, etc., is undeterminable."

Genus PELIDNA Cuvier.

102. (243a). *Pelidna alpina sakhalina* (Vieillot). Red-breasted Sandpiper.

This species does not appear to be common anywhere in Iowa. J. A. Allen lists it (White's Geol. of Iowa, ii, 425), and John Krider states that he "found it in September in Iowa, in large flocks" (Forty Years' Notes, 1879, 64). Kumlien and Hollister state that it is a "very abundant migrant in May, along Rock River. . . . We saw in May, 1899, fifty-three individuals killed by the discharge of a double-barrelled shot-gun. In September and October it is much less common, except along Lake Michigan" (Bds. of Wis., 1903, 47). P. B. Peabody describes myriads of waders at Heron Lake, Minn., May 19, 1894, the Red-backed Sandpipers everywhere, outnumbering all others five to one (Oöl., xii, 1, 1895). J.E.Law shot a pair May 26, 1896, at Bear Lake, Minn., just across the state line from Winnebago county.

County records: Linn—"rare migrant" (Berry). Lee—"rare, Keokuk district" (Praeger). Polk—"rare" (Johnson). Pottawattamie—"rare migrant" (Trostler). Woodbury—"uncommon transient" (Rich).

Genus EREUNETES Illiger.

103. (246). *Ereunetus pusillus* (Linn.). Semipalmated Sandpiper.

The little Semipalmated Sandpipers are common migrants in Iowa, usually in company with the Least Sandpipers. The spring migration is in May and the fall migration from the latter part of July until October. In Winnebago county I shot specimens on July 29 and 31, 1893, and in the University museum there are specimens taken at Burlington by Paul Bartsch on August 25 and October 15. On May 15, 1897, I picked up a crippled specimen under a rural telephone wire in Hancock county. A few observ-

ers report the species as rare: Van Buren (Savage); Winneshiek (Smith); Blackhawk (Walters).

104. (247). *Ereunetes occidentalis* Lawrence. Western Semipalmated Sandpiper.

This species closely resembles the preceding, but differs in having richer chestnut or rusty tints on back, and averaging slightly larger. Though called a western variety, it ranges to the Atlantic coast, in company with *pusillus*. Coues' Key gives the average length of bill as .66–.87 for *pusillus*, and .85–1.15 for *occidentalis*. Two specimens in the University museum, males, were taken at Burlington by Paul Bartsch, October 15, 1895; No. 16363, bill .96 inch; No. 16364, bill .95 inch.

The species is probably more common than the Iowa records would indicate, but the bird must be taken to be identified and is apt to be confused with the preceding. Both species are too small to be considered as "game birds," and are seldom shot.

Genus CALIDRIS Cuvier.

105. (248). *Calidris aredaria* (Linn.). Sanderling.

The Sanderling, a typical beach bird, is instantly recognized by its having no hind toe. The species is irregularly distributed in Iowa, being reported by only a few observers. Keyes and Williams stated that it was "not common. Occurs during migrations about the lakes of northern Iowa" (Bds. of Iowa, 1889, 122). In Nebraska it is "an irregular migrant, sometimes numerous; reported from Omaha by Trostler and Skow" (Rev. Bds. Neb., 41).

County records: Des Moines—a female specimen, juv., taken at Burlington October 15, 1895, by Paul Bartsch; Mus. Nat. Hist. No. 16339. Lee—"flocks are not rare about the middle of September. Earliest dates August 24; latest September 10. I have no spring records; Keokuk district" (Praeger). Linn—"rare migrant" (Berry). Mills-Pottawattamie—"common migrant" (Trostler).

Genus LIMOSA Brisson.

106. (249). *Limosa fedoa* (Linn.). Marbled Godwit.

The Marbled Godwit, the largest of the Bay Birds excepting the Long-billed Curlew, breeds chiefly in the interior of North America. It was formerly a tolerably common migrant in Iowa

and nested in various localities in the state. Of late years it has become very rare. Keyes and Williams give it as "migratory, not very common. Frequents prairie ponds during migratory periods" (Bds. of Iowa, 1889, 123). "Very common at Lake Mills, Iowa" (Krider, *Forest and Stream*, i, 15, 1873, 235) "Seen occasionally in spring only" (Decatur and Mahaska counties; Trippe, Proc. Bost. Soc., xv, 1872, 241). "A set of four eggs taken April 29, 1878, from a nest on a marsh at Oakland Valley, Iowa" (Goss, Birds of Kan., 187). J. W. Preston found the species breeding in Kossuth county in the early '80's (O. & O., xviii, 1893, 82), and it was also reported by Mr. Preston as "breeding at Clear Lake, Iowa" (Cooke, Bird Migr. in Miss. Val., 1884-85, 94).

County records: Boone—"migrant, quite rare" (Henning). Lee—"scarce migrant; Keokuk district" (Praeger). Mills–Pottawattamie—"rare migrant" (Trostler). Sioux—"tolerably common summer resident at Hawarden in 1890" (Berry). Webster—"occasional" (Somes). Winnebago—formerly summer resident, now very rare migrant. J. E. Law saw two flocks of seven each over the state line at Bear Lake, Minn., May 27, 1896, and shot three for identification (Anderson).

The species is conspicuous among the waders on account of its size and reddish color. When alighting, the bird has the habit of raising the wings over the back as it touches the ground.

107. (251). *Limosa hæmastica* (Linn.). Hudsonian Godwit.

This species is even rarer in Iowa than the preceding and there are only a few records.

County records: Blackhawk—"a rare spring migrant in Blackhawk county, where several specimens have been taken" (Peck). Linn—"rare migrant" (Berry). Monona—Mus. No. 17094, shot by D. H. Talbot at Blue Lake, May 7, 1884. Webster—"rare; three killed from a small flock by Earl Black in spring of 1897" (Somes). Woodbury—"rare transient" (Rich); Mus. No. 17093, in Talbot collection, taken at Sioux City by J. F. Baker (no date).

Genus TOTANUS Bechstein.

108. (254). *Totanus melanoleucus* (Gmel.). Greater Yellow-legs.

The Greater Yellow-legs is a fairly common migrant in nearly all parts of the state, and abundant in some localities. It is found

in spring chiefly during the month of April, but it has been noted as early as March 28 and as late as May 14 in Winneshiek county (Smith), and in the fall in September and October. The species has been reported as breeding in Iowa (Goss, Bds. of Kan., 189; Ridgway, Manual N. A. Birds, 165), but I have been able to find no definite records. The habit which many Sandpipers have of dallying about favorite feeding grounds until late in the spring and returning in midsummer has led many observers to consider them as breeding residents. The presence of straggling or unmated birds throughout the whole season is not necessarily proof of their nesting, however. The Yellow-legs are birds of restless habits, and their melodious whistle calls immediate attention to their presence in the vicinity. Cooke reported the Greater Yellow-legs as a common summer resident at Heron Lake, Minn. (Bird Migr. in Miss. Val., 1884-85, 95).

109. (255). *Totanus flavipes* (Gmel.). Yellow-legs.

The Yellow-legs, or Lesser Tell-tale, is a common migrant in Iowa, perhaps even more common than the Greater Yellow-legs. The two species are almost identical in form and coloration, but are readily distinguished by the size. It has been noted by practically all observers in the state. Cooke (Bird Migr. in Miss. Val., 1884-85, 95) states that "it is a common summer resident at Heron Lake, Minn., and has been found breeding in northern Illinois."

I have seen numbers of the birds lingering on the marshes of the Iowa River flats in Hancock county in the latter part of May, acting as if they were nesting, in company with Wilson Phalaropes, but have never found a nest. The Yellow-legs return early; shot one specimen July 27, 1893 (Winnebago), and they are usually numerous during the first half of August, in northern Iowa.

Genus HELODROMAS Kaup.

110. (256). *Helodromas solitarius* (Wils.). Solitary Sandpiper.

The Solitary Sandpiper, or Solitary Tattler, is a common migrant in most parts of the state and occasionally a summer resident. It usually arrives in the latter part of April and remains during the early part of May, returning in midsummer and remaining along the shores of ponds and banks of wooded streams until October. I have shot specimens July 15, 22 and

29, 1893, July 14, 24 and 27, 1894; May 18, 1895, a female in which the ovaries were undeveloped (all in Winnebago county). Dr. C. C. Smith states that it is a "common migrant and possibly a summer resident in Winneshiek county. I have seen it in spring between April 25 and May 22, and in summer and fall between July 6 and October 2." Wm. E. Praeger gives it as a common summer resident in the Keokuk district.

The Solitary Sandpiper is such an adept at concealing its nest that only one or two nests of eggs have ever been reported in print. It usually utters a low whistle when flushed from its haunts along a shaded stream, and, after alighting, generally raises the wings, displaying the beautifully barred axillaries.

Genus SYMPHEMIA Rafinesque.

111. (258). *Symphemia semipalmata* (Gmel.). Willet.

The Willet is a rather rare migrant in Iowa. It was listed by Allen (White's Geol. of Iowa, 1870, ii, 425). Thomas Say recorded its arrival at Engineers' Cantonment, May 6, 1820 (Long's Exp., i, 266-270). Hatch (Bds. of Minn., 1892, 140) says: "The Willet must breed, in occasional instances, in the most southern counties, for individuals are seen there during the summer months. . . . The nests have been found quite remote from water of any kind on the dry prairie south of the Minnesota River, and in the bottoms of that river." Kumlien and Hollister (Bds. of Wis., 1903, 50) state that: "Some numbers pass up the Mississippi and remain, or at least did, during June in the marshy tracts in the western part of the state, possibly a few nesting." Keyes and Williams (Bds. of Iowa, 1889, 123) give the Willet as "migratory; not uncommon about the sloughs."

County records: Lee—"rare migrant, Keokuk district" (Praeger). Winneshiek—"rare; reported by Mr. Hall Thomas" (Smith). Woodbury—"uncommon transient; probably 258a" (Rich).

112. (258a). *Symphemia semipalmata inornata* Brewster. Western Willet.

This subspecies is slightly larger and paler than the eastern form. While nominally a western variety, it has also been found along the Atlantic and Gulf coasts.

County records: Jasper—"Mr. Preston reported it as a rare breeder near Newton, Iowa" (Cooke, Bird Migr. in Miss. Val., 1884–85, 96). Lee—"a very rare visitant" (Currier). Poweshiek—"tolerably common transient" (Kelsey). Sioux—"I took a set of four eggs and shot the female of the Western Willet, June 2, 1900, near Hawarden, about a half mile from where I found the American Avocet. I still have the eggs in my possession" (Berry).

The University museum has two typical Iowa specimens: No. 1014, April 27, 1887, Johnson county, collected by G. Clark, measuring—wing 8.50; tail 3.91; bill 2.55; tarsus 2.72. A specimen taken August 15, 1893, at Burlington by Paul Bartsch, has the bill 2.63 inches long; body rufescent or salmon-tinted below, back and head much paler; no black except on tips of primaries.

Genus BARTRAMIA Lesson.

113. (261). *Bartramia longicauda* (Bechst.). Bartramian Sandpiper.

The Bartramian or Upland Sandpiper is the species most commonly known as "Plover" in Iowa. It is a tolerably common summer resident in most parts of the state, more frequent during migrations. In the earlier days it was generally found in the short grass of the upland prairies, but at the present time it is a resident of pastures, seldom appearing on low ground. The earlier observers (Trippe, Proc. Bost. Soc., xv, 1872, 241; Allen Mem. Bost. Soc., i, 1868, 501) speak of the species as very tame and unsuspicious, but persecution has made the bird more wary of recent years.

The Bartramian Sandpiper has a mellow, flute-like whistle, very melodious, and often given from the top of a post by the roadside. When alighting, the birds raise the wings to their fullest extent, holding them poised a moment before folding them. The nest is placed on the ground, usually on a hillside. I took a set of three slightly incubated eggs June 17, 1892, shooting the male bird from the nest (Winnebago); also four eggs, advanced in incubation, May 25, 1895, near Crystal Lake (Hancock). The eggs are excessively large for the size of the bird,—about as large as those of the Guinea-fowl. This gentle, confiding bird is one of the most attractive and pleasing features of the prairie country, and should be strictly protected.

Genus TRYNGITES Cabanis.

114. (262). *Tryngites subruficollis* (Vieill.). Buff-breasted Sandpiper.

This species appears to be very rare or irregular in Iowa. It was listed by Allen (White's Geol. of Iowa, ii, 1870, 425). Kumlien and Hollister give it as a rare migrant in Wisconsin; and it has been reported from Omaha (Rev. Birds Neb., 42).

The University museum has three specimens, in the Talbot collection, killed at Sioux City, August 2, 1884. G. H. Berry reports it as a "rare migrant; examined two birds shot at Norway, Iowa, in April, 1903, on Mud Creek."

Genus ACTITIS Boie.

115. (263). *Actitis macularia* (Linn.). Spotted Sandpiper.

The little Spotted Sandpiper is a common summer resident in all parts of the state. It may be known by its lustrous brownish-gray back and spotted under parts, as well as by its habit of incessant "teetering" or balancing fore and aft upon its legs, bobbing the tail up and down. The species is familiar to all who have spent any time along the banks of our streams in summer. It usually nests on sand-bars in the rivers or along their banks, but sometimes away from the water.

Dr. C. C. Smith states that he has seen the birds as early as April 17 and as late as October 17; eggs as early as May 10, in Winneshiek county. A downy young specimen in the University museum was caught May 31, 1901, at Iowa City, by S. B. Matson.

Subfamily NUMENINÆ. Curlews.

Genus NUMENIUS Brisson.

116. (264). *Numenius longirostris* Wils. Long-billed Curlew.

The Long-billed Curlew is the largest of our species of *Limicolæ* and is known by its sickle-shaped bill, four to eight inches long. It was formerly a common summer resident in Iowa, but now appears to be only a migrant, having disappeared from its former summer haunts with the breaking up of the original prairie sod.

Thomas Say mentions the arrival of the Long-billed Curlew at Engineers' Cantonment April 1, 1820 (Long's Exp., i, 266–270).

J. A. Allen stated that it was common in spring in western Iowa, and doubtless bred about the marshes (Mem. Bost. Soc., i, 1868, 501). T. M. Trippe says "a few seen in spring in Decatur county, where I was informed that formerly it bred quite commonly" (Proc. Bost. Soc., xv, 1872, 241). In 1884 the species passed through central Iowa April 15, and in 1885, from April 10 to 15, it was noted at Emmetsburg, Iowa, Heron Lake, Minn., etc., (Cooke, Bird Migr. in Miss. Val., 1884–85, 97–8). Keyes and Williams give it as "migratory, rather common. A few remain during the summer and nest on the open prairies" (Birds of Iowa, 1889, 123).

In early May, in the '80's, J. W. Preston found the species nesting in northern Iowa. He says "Lying away to the west were the dim flats of Kossuth county. Not a sound, no shrubs for sighing winds, the wheels rolled muffled in the prairie grass. At one point, where the ground lay more rolling and dryer, were many Long-billed Curlews guarding their nests, and hovering near the wagon, uttering that peculiar mellow whistle so characteristic of the wild free prairie. Soon I was delighted to see an old Curlew flutter from the horses' feet, leaving the four speckled eggs exposed. Further on a mother Curlew led her mottled downy chicks from danger." ("Some Prairie Birds," O. & O., xviii, 1893, 82).

Dr. Trostler reports the Long-billed Curlew as a common migrant in Pottawattamie and Mills counties. A. I. Johnson reports it as a migrant in Sioux county, northwestern Iowa, saying: "I do not know of its nesting since I came to the state in 1890. Have only known of them during migration, and not very many at that." All others who reported list the species as a rare migrant.

117. (265). *Numenius hudsonicus* Lath. Hudsonian Curlew.

This species is a rare migrant in Iowa. It was listed by Allen (White's Geol. of Iowa, ii, 1870, 426). Cooke (Bird Migr. in Miss. Val., 1884-85, 98) says: "The only record received came from Heron Lake, Minn., May 1, 1884."

G. H. Berry reports it as a rare migrant in Linn county. I have a female specimen of the Hudsonian Curlew in my private collection, shot on the prairie west of Crystal Lake, Hancock

county, May 25, 1895. The bird was alone and very wary and much careful stalking was necessary in order to secure it.

118. (266). *Numenius borealis* (Forst.). Eskimo Curlew.

The Eskimo Curlew is also a rare migrant in Iowa. It was listed by Allen (White's Geol. of Iowa, ii, 1870, 426), and John Krider says: "I found it in Iowa in May, migrating westward" (Forty Years' Notes, 1879, 68).

County records: Des Moines—Mus. No. 16803, taken at Burlington, April 5, 1893, by Paul Bartsch. Jackson—"rare transient" (Giddings). Johnson—specimens in University museum taken by Frank Bond (Nutting, Proc. Iowa Acad. Sci., 1892). Van Buren—"spring migrant, very rare" (W. G. Savage).

Family CHARADRIIDÆ. Plovers.

The Plovers, in a general way, resemble the true Snipe, but have, as a rule, shorter, thicker bills, which are not adapted for probing. They pick up their food from the surface of the ground, and are found on uplands quite as frequently as upon the shores.

Genus SQUATAROLA Cuvier.

119. (270). *Squatarola squatarola* (Linn.). Black-bellied Plover.

The Black-bellied Plover is a rather rare migrant in Iowa, and somewhat irregular in its occurrence. In some plumages it resembles the Golden Plover, but may be recognized by the presence of a very small hind toe. John Krider mentions the species as "abundant in Iowa, where it arrives about the first of May, feeding over the plowed ground" (Forty Years' Notes, 1879, 61); also as "very common at Lake Mills, Iowa" (*Forest and Stream*, i, 15, 1873, 235). Shoemaker listed the Black-bellied Plover as an abundant migrant in Franklin county (1896), and Berry as a tolerably common migrant in Linn. Most observers consider the species as rare. A specimen in the University museum, No. 16304, was taken at Burlington, Aug. 13, 1894, by Paul Bartsch.

Genus CHARADRIUS Linnæus.

120. (272). *Charadrius dominicus* Müll. American Golden Plover.

The American Golden Plover is rather more common in Iowa than the preceding species and may be readily distinguished by its lack of a hind toe. It occurs only as a migrant. "In the

spring of 1884 it was noted from latitude 39° in Missouri to 41° 42′ in Iowa between March 21 and 27. Then no more records were made until after the April storms. April 29 it reached Heron Lake, Minn. In 1885 they came to Des Moines April 16; Heron Lake, Minn., May 4" (Cooke, Bird Migr. in Miss. Val., 1884–85, 99). Trippe reported it as abundant in spring and fall in Decatur and Mahaska counties (Pr. Bost. Soc., xv, 1872, 240), and Allen as "not seen until September 18th [in western Iowa], when it became common" (Mem. Bost. Soc., i, 1868, 501). J. W. Preston observed large flocks wheeling over the burned tracts of prairie in early May in Kossuth county (O. & O., xviii, 1893, 82). The reports of observers vary as to the abundance of the Golden Plover, some listing it as rare, others as a common migrant.

"At Davenport, October 24, 1889, one was found in the morning lying dead under a hundred-foot electric light tower which it had struck while migrating during the night" (Burtis H. Wilson). "I never have seen this bird alive in Iowa, but about 1889 (in May) there was a heavy shower, almost a cloud-burst, about 8:10 p. m., and the streets were full of drowned birds, among them about a hundred Golden Plover" (G. H. Berry, Cedar Rapids).

Genus OXYECHUS Reichenbach.

121. (273). *Oxyechus vociferus* (Linn.). Killdeer.

The Killdeer or Killdeer Plover is the commonest representative of the family in Iowa. It is an abundant summer resident in all parts of the state and is generally known from its shrill, plaintive "*kill-dee*" note, which is often repeated and heard at all times and places along the shores of ponds, on pastures and fields, or when migrating at night. The four eggs are laid on the ground, without much pretence of a nest, in pastures or even in plowed fields. I have found several nests placed upon the hills of a frequently cultivated potato patch. The bird becomes very noisy and feigns lameness when the nesting site is closely approached, but usually slinks away for some distance before giving voice, so that its exact location is difficult to discover. The Killdeer is very restless when feeding, running rapidly from one point to another and frequently flying for short distances. It is an early migrant, arriving in March with the ducks and remaining until late in October.

Genus ÆGIALITIS Boie.

122. (274). *Ægialitis semipalmata* Bonap. Semipalmated Plover.

The Semipalmated Plover is occasionally taken in Iowa during the migrations, but is not known to breed in the state. In Wisconsin, Kumlien and Hollister state that it is a common migrant during May and the first two weeks of June, and again during August and September. Numbers remain about the larger inland lakes and Lake Michigan during the summer (Birds of Wis., 1903, 54).

County records: Blackhawk—"appears to be generally distributed over the state in spring and fall migration, but not very abundant. Usually seen in small flocks in company with Killdeers, Spotted Sandpipers and other waders" (Peck). Des Moines—Mus. No. 16480, August 13, 1891; No. 16338, August 19, 1891; Burlington (Paul Bartsch). Jefferson—"observed about Jefferson in September" (Allen, Mem. Bost. Soc., i, 1868, 501). Johnson—"secured near Iowa City last spring. Specimen in University museum [Vogt's Swamp, May 27, 1892]" (Nutting, Proc. Iowa Acad. Sci., 1892). Lee—"common migrant" (Praeger); "migrant, not common" (Currier). Linn—"rare migrant" (Berry). Mills-Pottawattamie—"abundant migrant" (Trostler). Winneshiek—"rare migrant; have seen it only two or three times; taken May 27, 1897" (Smith).

123. (277). *Ægialitis meloda* (Ord). Piping Plover.

The Piping Plover is a rare migrant in Iowa. Some of the records of the next variety may be confused with this, the only difference being that in *Æ. m. circumcincta* the black patches on the sides of the neck coalesce in front. In Wisconsin, Kumlien and Hollister state that from 1870 to 1900 more specimens were procured with the complete "ring" than without (Birds. of Wis., 1903, 54).

C. C. Nutting reports: "Piping Plover *Ægialitis meloda* Ord, Burlington, Iowa, Aug. 21, 1892, Paul Bartsch. This specimen was killed nearer the Illinois than the Iowa side of the river and is, therefore, not strictly an Iowa record" (Proc. Iowa Acad. Sci., 1894, 44). Wm. E. Praeger writes: "One specimen shot by myself on August 25, 1894, Keokuk, Iowa. I have recorded it as 277, but no longer have the skin; expect my record will stand."

124. (277a). *Ægialitis meloda circumcincta* Ridgway. Belted Piping Plover.

This subspecies of the Piping Plover is considered the typical form of the interior, "breeding from Illinois to Lake Winnipeg." Cooke states that "it was reported as breeding at Grinnell, but was not noted during migration" (Bird Migr. in Miss. Val., 1884–85, 101).

County records: Des Moines—A specimen in the University museum, No. 16342, taken at Burlington, August 27, 1893, by Paul Bartsch, has the dusky collar nearly meeting across breast. Dickinson—"shot specimens at Spirit Lake July 30, 1902" (Bailey). Linn—"spring and fall migrant" (Bailey); "tolerably common migrant; occasional summer resident" (Berry). Lee—"migrant; not common" (Currier). Poweshiek—"rare transient" (Kelsey). Webster—"few" (Somes). Winnebago—"quite numerous near Rake, May 22, 1891" (Halvorsen). Woodbury—"uncommon transient" (Rich).

Family APHRIZIDÆ. Surf-birds and Turnstones.

This is a small family, with three North American species. They are almost strictly maritime and only occur as stragglers in the interior.

Genus ARENARIA Brisson.

123. (283.1). *Arenaria marinella* (Linn.). Ruddy Turnstone.

The Turnstone is of very rare occurrence in Iowa. John Krider states (Forty Years' Notes, 1879, 62): "*Strepsilas interpres* Illig. Very abundant about the 10th of May along the seashore, feeding upon the eggs of the king-crab; and arrives about the same time in Iowa in great numbers, feeding on the craw-fish about the sloughs on the prairie."

Paul Bartsch records "First Record of the Turnstone in Iowa, May 21, 1892" (Iowa Orn., iv, 3, 1898, 3): "A pair seen on railroad tracks near Burlington bridge. When started up, crossed river, circled over city of Burlington, and returned to same place. Both killed in Illinois, but will have to be added to the list of Iowa birds as we also observed them in Iowa." One of these specimens is now in the University museum.

George H. Berry gives the Turnstone as a "rare migrant in Linn county; one shot in 1890 on Prairie Creek, between Cedar

Rapids and Fairfax, by a hunter from Cedar Rapids." "Spring and fall migrant—Linn" (Bailey). "Straggler—Mills county" (Trostler).

Order GALLINÆ. Gallinaceous Birds.

Suborder PHASIANI. True Fowls.

Family TETRAONIDÆ. Grouse, Partridges, Quails.

The Grouse are heavy, ground-inhabiting birds, usually found in coveys or flocks after the nesting season. They are the most highly prized of the game birds, and their habits are too well known to need description. While their food consists to a considerable extent of grain and seeds, the large numbers of insects which they destroy in summer make them valuable allies of the farmers. Moreover, the grain which is consumed by them is usually gleanings or scatterings which otherwise would be wasted.

Subfamily PERDICINÆ. Partridges.

Genus COLINUS Lesson.

126. (289). *Colinus virginianus* (Linn.). Bob-white.

The Bob-white, universally known as "Quail" in Iowa, is a common or abundant resident in all parts of the state. It was much less common during the early days of settlement of the state, particularly in the northern and northwestern sections, but with the clearing of the woods and cultivation of the prairies the Quails became more numerous and, when protected, very tame and almost semi-domesticated at times. The cheery "*bob-white*" note of the male bird may be heard during the whole summer from the tops of country fence-posts. As nests with eggs are found during the summer from the first of June until the last of August it is probable that two broods are hatched. I found a nest containing fifteen eggs June 5, 1897, in the grass by the roadside, in Hancock county, and a nest with twelve eggs by the road between Spirit Lake and Okoboji, August 18, 1901, most of the eggs in the latter nest being pipped. C. F. Henning (Boone) records a set of fourteen eggs, August 27, and a nest with thirteen eggs one week later (O. & G., xviii, 1893, 143).

Many of the Bob-whites are frozen to death during severe winters, a flock being snowed under as it huddles in a compact bunch

in some fence-corner. About 1890 the species was nearly extinct in Winnebago and Hancock counties, but the number rapidly increased from year to year until it is now common. Dr. Smith has noticed the same state of affairs in Winneshiek county. Though the pairs scatter during the nesting season they assemble later in coveys, frequenting grain-fields in the fall and thickets, corn-fields and bottom-lands in the winter.

Genus CALLIPEPLA Wagler.

Subgenus CALLIPEPLA Wagler.

127. (293). *Callipepla squamata* (Vig.). Scaled Partridge.

"A single specimen of this southwestern bird, shot at Tabor, Iowa, May 2, 1889, was exhibited by Prof. J. E. Todd at the meeting of the Iowa Academy of Sciences, September 5, 1899. It was doubtless a straggler, and the species cannot be considered as belonging to our state fauna" (Herbert Osborn, Catalogue of Animals represented in the collection of the Iowa Agricultural College. 1891, p. 7).

Subfamily TETRAONINÆ. Grouse.

Genus BONASA Stephens.

128. (300). *Bonasa umbellus* (Linn.). Ruffed Grouse.

The Ruffed Grouse, commonly known as "Partridge" or "Pheasant," is now a rare bird in most localities in the state, where it was formerly common. It is a resident species and a few pairs still linger wherever the native woodland remains uncleared, and in the springtime, and rarely in autumn and winter, the dull, muffled drumming of the male bird may be heard as, standing on some fallen log or stump, he beats the air with his wings. The species is reported as still common in restricted localities in the state. G. H. Berry reported that one hunter killed over twenty in one day along the Cedar River in Linn county in 1903.

Major Bendire states in his Life Histories of North American Birds: "Mr. Lynds Jones of Grinnell found a nest of the Ruffed Grouse in a hollow stump" (vol. i, 61). "Sets of sixteen eggs or over are of rare occurrence, but I have a reliable record of one numbering twenty-three eggs. Mr. John F. Paintin of Coralville, Iowa, found the set May 26, 1886, near the Iowa River, ten miles north of Iowa City. He was walking along in the timber, and

in stepping over a rotten log almost stepped upon the grouse. The eggs were carefully counted and the number found to be twenty-three; they were almost hatched and were not disturbed" (*ibid.*, 1, 53).

I have noticed that the Ruffed Grouse sits very close, depending upon its protective coloration harmonizing with the dead brown leaves which invariably cover the ground around the nest.

Genus TYMPANUCHUS Gloger.

129. (305). *Tympanuchus americanus* (Reich.). Prairie Hen.

Though the species has been dignified by the book-names of Pinnated Grouse and Prairie Hen, in the vernacular of sportsmen, hunters, and all who have known the bird in its native haunts, the name has always been, and bids fair to remain, "Prairie Chicken" or simply "Chicken." The Prairie Chicken was formerly an abundant bird in all parts of the state, resident throughout the year, and in many cases supplying the early settler with his main supply of fresh meat. From continual persecution by hunters—farmers' boys and city sportsmen—with guns, dogs, and traps, the destruction of the eggs and young, their numbers have been greatly reduced until, while perhaps not actually extinct in any county of the state, in most localities the Prairie Chicken is very rare and can only be considered common in the northern and northwestern portions of the state.

The Prairie Chicken formerly nested upon the upland prairie hillsides, but of recent years, owing to the thick settlement of the country, practically all such land is used for cultivation or pasturage and the Chickens have been forced to resort to the taller grass around the edges of sloughs and ditches. The burning of the slough grass in the spring is responsible for the destruction of many nests, and a wet spring and summer always results in a small crop of Prairie Chickens. In late summer and early fall (from my observations in Winnebago county) they frequent the shade of tall weeds around sloughs, feeding on the stubble-fields in the evening and morning. About October 1st the survivors of the coveys take to the corn-fields, becoming very wary, and remain there most of the winter. A hunter may flush a covey, mark them down at the edge of another field and, following them up, find that they have run silently and rapidly to the other side

of the field, perhaps a quarter of a mile away, taking flight as soon as he enters the field.

While a certain number remain throughout the winter, large flocks pass southward early in the winter, returning in March. On a few occasions I have seen Chickens roosting in trees in the winter time, but this is unusual. They frequently burrow in snow-banks for the night, and are often snowed under. On the afternoon of February 9th, 1894, while wading through deep, soft snow in a slough, two Chickens burst up through the thin crust not ten feet away. Several other burrows were noticed in the snow in the vicinity. In winter, I have heard many authentic reports of Chickens being killed by flying against telegraph and telephone wires.

W. W. Cooke, in "Bird Migration in the Mississippi Valley, 1884–5," p. 104–6, says:

"The Prairie Chicken is commonly said to be a resident bird, and so it is in the larger part of its range; but in Iowa a regular but local migration takes place. . . . In November and December large flocks of Prairie Chickens come from northern Iowa and southern Minnesota to settle for the winter in northern Missouri and southern Iowa. This migration varies in bulk with the severity of the winter. During an early cold snap immense flocks come from the northern prairies to southern Iowa, while in mild, open winters the migration is much less pronounced. During a wet, cold spring the northward movement in March and April is largely arrested on the arrival of the flocks in northern Iowa, but an early spring, with fine weather, finds them abundant in the southern tier of counties in Minnesota, and many flocks pass still farther north. The most notable feature is found in the *sex* of the migrants. It is the females that migrate, leaving the males to bear the winter's cold."

In the spring of 1897 I had a good opportunity to study the "booming" or so-called courtship antics of the male birds, in Winnebago county. A certain number of males resort to the same spot every morning and evening for a period of about two months in the spring.

March 24—Saw about a dozen Chickens "booming" for the first time this spring, upon a low, flat-topped hill, nearly surrounded by a slough. The sound is very deceptive; when close it appears far away, and when a mile away may seem very near. April 6—Built a "blind" on same hill, covering it with hay.

April 10—Observed Chickens from "blind." They began to fly in about 5:45 p. m. All were males, as on all subsequent occasions, which leads me to doubt that the performance is entirely for the benefit of the hen birds. When ready to "boom," or "coo," as I should prefer to call it, the cock scratches the ground with both feet very rapidly for a second, then bending the body forward and downward, wings drooping to the ground, and tail spread, the orange-yellow neck-sacs are inflated and the air is forced out with a rolling *doo—doo—doo*, the last syllable prolonged and the head bobbing with each sound. The bird then straightens up, deliberately walks a few steps, and repeats the operation. Frequently two or three cocks are cooing at once, making a prolonged and continuous *doo—oo—oo—doo*, often intermingled with a clucking *took! took! took! took!* or a loud shrill *ca—ca—ca—ca—caa!* the last syllable very shrill. While cooing, the sack under the throat becomes nearly spherical, but the feathers along the median line dividing the yellow skin sometimes make it appear to bulge out at the sides. The cooing continued for some time after dark. The birds seemed very pugnacious and many spectacular and ceremonious combats occurred, two cocks advancing toward each other, bowing deliberately, until they would suddenly spring together, one sometimes jumping over the other's head. None seemed to be injured by these tilts, however.

In the mornings they begin to coo by five o'clock or earlier, usually ceasing before seven. On cold days they were not so noisy. On April 22 they were noisy at times, but strangely quiet at intervals, being only aroused from their apathy to answer another distant chorus from the west. The last cooing of the Prairie Chickens for the season which I heard was on the morning of May 27.

The eggs are usually laid in May, although unfavorable seasons may delay the hatching time until after the middle of June. May 5, 1895, I found a nest containing ten fresh eggs in tall dead grass, about three feet from a ditch containing running water; May 18, 1895, twelve fresh eggs, on dry ground, in a low place; May 25, 1895, twelve eggs, nearly ready to hatch, on upland prairie, all in Hancock county, Iowa. While I have seen a number of Prairie Chicken's eggs hatched out under domestic hens, the deeply inherent wildness of the chicks prevented them from being raised to maturity.

Genus PEDIOCÆTES Baird.

130. (308b). *Pediocætes phasianellus campestris* Ridgw. Prairie Sharp-tailed Grouse.

The Prairie Sharp-tailed Grouse, the "Pintail Chicken" of the Northwest, east of the Rocky Mountains, is probably extinct in Iowa, although it was undoubtedly found in the state formerly. Thomas Say mentions its occurrence at Engineers' Cantonment in 1819–20 (Long's Exp., i, 265). John Krider says: "I found this bird in Iowa and Minnesota, where it breeds" (Forty Years' Notes, 1879, 56), and "very common at Lake Mills, Iowa" (*Forest and Stream*, i, 15, 1873, 235). "They were recorded as rare residents at Grinnell, Iowa" (Cooke, Bird Migr. in Miss. Val., 1884–85, 106–7). Keyes and Williams give it as "common on the prairies of northwestern Iowa" (Bds. of Iowa, 1889, 125). F. V. Hayden says: "This bird is seldom seen below Council Bluffs. From thence to the mountains it is very abundant" (Trans. Am. Philos. Soc., xii, 1863, 172). Dr. Coues, tracing the habitat of the Sharp-tailed Grouse, in 1874 (Birds of the Northwest, page 407), says:

"The latter inhabits the western portions of Minnesota and Iowa, all of Dakota, thence diagonally across Nebraska and Kansas to Colorado. . . . Its southwest trend is confirmed by Mr. Trippe, who believes that the Sharp-tailed scarcely* comes to Iowa. (*But I am reliably informed of its occurrence, with *Cupidonia*, in northwestern portions of Iowa); and more particularly by my own observations, between Fort Randall and Yankton. . . . The *Cupidones* are unquestionably creeping up the Missouri just as the Quail have done, although they have not, apparently, as yet progressed quite so far; and with their advancement, the Sharp-tailed are probably receding along this line as elsewhere."

This westward extension of the limits of the Pinnated Grouse and simultaneous recession of the Sharp-tailed species is still going on. In 1899, in North Dakota, I found the limits of the two species overlapping in Nelson county, in about the region of Stump Lake. Mr. Alf. Eastgate, a resident collector of many years' experience, informed me that the Prairie Sharp-tailed Grouse were rapidly disappearing from that region as the Pinnated Grouse moved westward.

G. H. Berry writes: "The only birds I ever saw in Iowa were in Winneshiek county, in 1889, when I shot two birds out of

about nine, some four or five miles southeast of Hesper (near State line) in the northeastern part of Winneshiek county, on what was called the Casterton Farm. I have never been there since, but a friend of mine says he shot a prairie chicken three years ago directly south of Decorah, same county, that was unlike the rest they shot, and the only ones he ever saw like it were some shot in North Dakota, so I think there may be a scattering few yet remaining in that locality."

A. I. Johnson writes: "The years of 1890–91 I lived at Hull, Sioux county, Iowa, and hunted considerably, but although I was on the lookout for this bird I never found one or knew of one being taken anywhere in that locality." W. H. Bingaman of Algona writes: "I have never seen or heard of Prairie Sharp-tailed Grouse in this state, and every fall I shoot hundreds of chickens and formerly bought for market, but I have never seen one that was taken in Iowa" (Kossuth).

Family PHASIANIDÆ. Pheasants, Turkeys.

This family includes the common fowl and various Old World Pheasants, the only American representatives being the Turkeys.

Subfamily MELEAGRINÆ. Turkeys.

Genus MELEAGRIS Linnæus.

131. (310a). *Meleagris gallopavo silvestris* (Vieill.). Wild Turkey.

The Wild Turkey, the noblest American game bird, was once fairly common in the wooded districts of the state, but is now practically extinct. A few straggling birds are said to still survive on a protected farm in Lee county.

The Lewis and Clark Expedition in 1804 (Coues' Hist. of L. & C. Exp., i, 54) found Turkeys common at various points along the Missouri—July 22–26, 1804, below mouth of Mosquito Creek, Mills county; July 31—north of Boyer's Creek; August 9—Monona county. Thomas Say found them at Engineers' Cantonment in 1819–20. Prince Maximilian observed numbers at various points along the Missouri in 1834 (Reise, ii, 343): May 13, 1834, below Boyer's Creek; May 13, near Bellevue, Nebraska; May 14, "Wheeping-water Creek . . . wir steigen öfters an das Land, um wilde Truthüner zu jagen, deren Stimmen zu uns berüber schalten. Oefters trafen wir diese stolzen Vögel in hohen luft-

igen Waldstämmen an, unter welchen ein üppiger Grasswachs aufsprosste; sie standen aber zu hoch fur die Schrotflinte."

In 1843 Audubon saw three Turkeys above Council Bluffs, on May 10 (Journals, i, 482); May 13, "started several Turkey cocks from their roost" (Floyd's Bluff and mouth of Big Sioux, Ibid., 488–9); October 1, "landed below the [Big] Sioux River to shoot Turkeys, having seen a big male on the bluffs. Bell killed a hen and Harris two young birds" (Ibid., ii, 70).

T. M. Trippe, writing from Decatur and Mahaska counties (Proc. Bost. Soc., xv, 1872, 240), says the Turkey is "not uncommon, but from its being constantly persecuted, very shy and vigilant." In 1889 (Bds. of Iowa, 125), Keyes and Williams give it as "resident; formerly very abundant, but becoming less abundant each year. A few are occasionally taken in the heavily timbered districts along the streams."

A number of observers have reported the Turkey as formerly occurring but now extinct in their localities. Paul Bartsch (Iowa Orn., ii, 1, 1895, 3) tells how a Burlington game dealer discovered a flock two years before and succeeded in killing every one of the thirteen birds. W. G. Savage informs me that they were very plentiful thirty years ago in Van Buren county, but now none are to be found, the last one being seen six years ago. W. G. Praeger states that he was "recently informed that they are now quite extinct near Keokuk, were still fairly common up to 1890, and the last I heard of was about 1895."

Edmonde S. Currier reports: "This bird is almost extinct in Iowa, but not quite. October 24, 1903, two were flushed in a woodland west of Donnellson, Lee county. This was on a large farm where no shooting has been allowed for many years, and a small flock of turkeys can be seen there even yet. November 13, 1898, I saw a fine male that had been killed from a gang of seven three miles west of Summitville, Lee county, on Grape Creek." In 1900 and 1902 Mr. Currier also saw fresh tracks of Turkeys and heard the birds calling in the woodland in the latter locality.

Order COLUMBÆ. Pigeons.

Family COLUMBIDÆ. Pigeons and Doves.

Only two species of the family are found in Iowa, one of these being practically extinct. They are principally ground-feeding birds, living almost wholly upon grains and seeds.

Subfamily COLUMBINÆ. Arboreal Pigeons.

Genus ECTOPISTES Swainson.

132. (315). *Ectopistes migratorius* (Linn.). Passenger Pigeon.

The Passenger Pigeon, the "Wild Pigeon" whose enormous flights were the wonder of the early settler, is now practically extinct in Iowa, although there are a few records of straggling migrants during recent years.

Thomas Say noted the arrival of the species at Engineers' Cantonment, May 2, 1820. S. F. Baird records a specimen taken at the mouth of the Big Sioux, May 3, 1856, by Dr. Hayden (9th Pac. R. R. Rep., Part 2, Birds, 600). In Decatur and Mahaska counties, T. M. Trippe observes that it "occurs regularly, chiefly in spring and fall, sometimes in large flocks. Not observed to breed" (Proc. Bost. Soc., xv, 1872, 240). John Krider states: "I found it in Iowa in 1875, breeding in Benson Grove [now Leland, Winnebago county], and also at Clear Lake, where it was more plenty" (Forty Years' Notes, 55). Keyes and Williams state: "Large flocks occasionally appear in different parts of the state. A few are usually seen each spring, and a few pairs sometimes breed within the limits of the state. A nest with one egg was taken at Charles City, June 14, 1879" (Bds. of Iowa, 1889, 125). A few of the later records are given below:

Blackhawk—"our latest record is eighteen years old" (Peck). Des Moines—Last record, a flock of about twenty on Mississippi between Burlington and Dallas in fall of 1891 (Bartsch, Iowa Orn., ii, 4, 1895, 1–2). Franklin—"a flock of about twenty birds was seen frequently in Mayne's Grove during the spring of 1893 and one was found dead; this is my only record" (Shoemaker). Kossuth—"three were seen April 6, 1903" (Bingaman). Lee—"saw a single female May 19, 1896, and shot a single young male Sept. 7, same year. They are said to have been common in 1884" (Praeger); "last ones seen May 13, 1899" (Currier). Linn—"two seen in May, 1901, a couple miles below Cedar Rapids, the only ones I ever saw in Iowa" (Berry). Poweshiek—"I saw two flocks and killed six birds about 1881" (Lynds Jones). Winneshiek—"I have never seen this species. It was very common 15–20 years ago. A farmer tells me of seeing a small flock in April, 1895. He told me that it used to be seen in immense flocks in April and

in the fall, remaining about two weeks. A few remained to breed" (Smith). My mother tells of immense flocks which visited Winneshiek county in the '50's, alighting in the timber, where the boys killed large numbers at night by knocking them from the branches with sticks.

Subfamily ZENAIDINÆ. Ground Doves.

Genus ZENAIDURA Bonaparte.

133. (316). *Zenaidura macroura* (Linn.). Mourning Doves.

The Mourning Dove or Turtle Dove is an abundant and familiar summer resident in all parts of the state, and the mournful cooing note may be heard almost anywhere during the mating season. Two or three broods are reared during the season. I have found fresh eggs in Winnebago county in all the months from April 30 to September 1. The nest is a very carelessly made affair, composed of a few twigs loosely thrown together, usually in a bush or a low tree. In Clyde county, Kansas, I found one nest July 21 and one July 22, 1903, on the ground in freshly-cut wheat stubble. Dr. Rich also records several instances of the Mourning Dove breeding on the ground (West. Orn., v, 1, 1900).

The Mourning Dove usually arrives from the south in March and departs in the latter part of October. During the nesting season they are usually in pairs, but in the fall assemble in flocks of varying size and frequent grain and stubble fields. At sunset numbers regularly gather on the shores of some pool to drink. A few birds frequently remain during mild winters as far north as the center of the state.

Winter records: Blackhawk—"from one to five generally remain here all winter; none observed here in winter of 1903–04" (Salisbury). Jackson—"abundant; resident" (Giddings). Jasper —"reported all winter in 1890, at Baxter, about the stock yards, by J. W. Preston" (Bendire, Life Hist. N. A. Bds., 141–42). Johnson—occasional in winter (Anderson). Lee—"a few remain all winter" (Currier). Linn—"a few are spending the winter here (1903–04); as many as twelve have been seen at one time" (Keyes). Muscatine—"Jan. 26, saw two common Doves; ground entirely covered with snow, and 6° below zero. In mild weather they are sometimes seen in January and February, but this has been an unusually severe winter" (C. N. P., O. & O., vi, 1, 1881, 7).

Boone—"I have met with it during mild winters in the heavy timber along the Des Moines River bottoms" (Henning). Winneshiek—"a few remain throughout the winter in cattle yards" (Smith).

Order RAPTORES. Birds of Prey.

Suborder SARCORHAMPHI. American Vultures.

Family CATHARTIDÆ. American Vultures.

The Vultures are large, heavy birds, with great powers of soaring flight. They feed principally upon carrion and are exceedingly useful as scavengers in southern localities.

Genus CATHARTES Illiger.

134. (325). *Cathartes aura* (Linn.). Turkey Vulture.

The Turkey Vulture, or Turkey Buzzard, as it is more familiarly known, is a tolerably common summer resident in some parts of the state, arriving early in April and leaving in November, and a rare or infrequent visitor in other parts. Nests are occasionally found. In the earlier days the species was apparently more common. J. A. Allen (Mem. Bost. Soc., i, 1868, 500) says: "At Panora I once saw them congregated in hundreds, attracted by two dead pigs. Frequently observed them resting on the fences and wheat stacks, in very hot days opening their wings to catch the breeze, the very picture of indolence. In southern Guthrie county is a locality known as 'Buzzards' Roost,' it is said from the number of these birds that resort there."

Major Bendire, in his "Life Histories," 1892, p. 163, says: "Mr. Lynds Jones writes me from Grinnell, Iowa, 'I once started a Turkey Buzzard from her nest and found, among the matter thrown up, mice and pieces of a skunk, evidently very recently killed. . . . The nesting site was a hollow stump, resorted to year after year.' . . . Mr. J. W. Preston states: 'At Spirit Lake, Iowa, I took a set of two eggs from an old elm tree, which leaned in the form of an arch; the bird made its way into the tree at the broken-off top and deposited the eggs near the roots of the tree.'"

E. B. Webster writes me, March 1, 1897: "Breeds, or one pair of them did, on the upper Iowa River in the northern part of our county (Howard) a few years ago; frequently see them." Morton E. Peck says it "formerly bred quite frequently in Blackhawk

county in hollow trees, and more recently on the Palisades of the Cedar River in Linn county. Now seldom seen except in migration." Chas. R. Keyes gives it as a "fairly common summer resident in Linn county. Breeds in caves along the Cedar River."

Suborder FALCONES. Diurnal Birds of Prey.

Family FALCONIDÆ. Vultures, Falcons, Hawks, Eagles, Etc.

The birds included in this family are well-marked in structure and characteristics. They possess great bodily strength and strong powers of flight, obtaining their food, which consists of small mammals, birds, reptiles, and insects, by capturing it alive. Nearly every species is of great benefit to the farmer as a destroyer of the multitudes of the small rodents which injure the crops. Great masses of statistics have been collected which show that the value of the poultry and game birds consumed by them is infinitesimal when compared with the services rendered in other ways. With the possible exception of two or three species, they should be strictly protected.

Subfamily ACCIPITRINÆ. Hawks.

Genus ELANOIDES Vieillot.

135. (327). *Elanoides forficatus* (Linn.). Swallow-tailed Kite.

The Swallow-tailed Kite was formerly a tolerably common summer resident throughout the state, but of recent years it is of infrequent occurrence, though reported by nearly all observers.

Thomas Say observed the species in Pottawattamie county in 1819-20. Prince Maximilian also observed it on the Missouri (Reise, i, 306): May 8, 1833—"Etwas weiter aufwärts tritt Floyd's-River hervor, und an den Floyd's Hügeln zeigen sich einzelne Nadelholz-Baüme, über dene der weisse gabelschwänzige Milan (*Falco furcatus*) in der Luft schwebte." . . . (Ibid. ii, 340) May 11, 1834 (mouth of Little Sioux), "bemerkten in der Luft ein Paar der schönen weiss und schwarzen Milanen, welchen die französichen Abkommlinge am Mississippi la fregata nennen." Audubon noted "a Swallow-tailed Kite" near Council Bluffs in 1843 (Journals, i, 481).

J. A. Allen (Mem. Bost. Soc., i, 1868, 500) writes: "Common. Often seen in considerable numbers, and generally over or near

the timber skirting the streams. At Denison, in the timber of the Boyer River, they were very common and nesting; the nests being placed on horizontal branches, at some distance from the trunk. By the middle of July the young had not flown. With a peculiarly graceful, swallow-like flight this beautiful bird was seen not infrequently skimming over the prairie, singly or two or three in company, eagerly searching for their reptile food." John Krider (Forty Years' Notes, 1879, 10) says: "I have found it very abundant in Iowa, Minnesota and Kansas, where they breed. The first nest I found was at Coon Lake, Iowa. I watched the birds building, and only obtained one egg, which is now in the Smithsonian Institution, Washington, D. C." Baird, Brewer and Ridgway (N. A. Birds, iii, 1875, 192) describe an egg taken in Iowa by Krider; and Bendire, in his "Life Histories," figures a type specimen of an egg taken in Blackhawk county, June 3, 1875. Morton E. Peck writes me that it "once bred regularly in Blackhawk and Benton counties, where a number of sets of eggs were taken by George D. Peck, the last in about 1877. At present it rarely if ever appears in the county."

Various observers give the food of this species as consisting chiefly of snakes, frogs and grasshoppers. It has been recorded in Iowa at various dates from April until December, but the larger number of specimens appear to be seen in September.

Genus ICTINIA Vieillot.

136. (329). *Ictinia mississippiensis* (Wils.). Mississippi Kite.

Though the Mississippi Kite has been quoted by nearly all authorities as ranging north "casually to Iowa and Wisconsin," I was for a long time constrained to place it in the hypothetical list for want of a definite, authentic record of its capture in Iowa. It has been referred nominally to Iowa by Thomas Say, Baird, Brewer and Ridgway, Allen, Goss, Fisher, Coues, Ridgway, Bendire and others, but no recent records have appeared in print.

County records: Blackhawk—"only one observed here. I remained over half an hour within twenty feet of the bird when it was resting on a post in hedge, so that identification is positive" (Salisbury). Linn—"rare summer resident" (Berry). Van Buren—"a kite of this species occurred one spring on Big Cedar at a certain place and stayed four or five weeks, then dis-

appeared. I saw the bird many times and once while fishing it came and sat within twenty yards of me, so I positively identified it. The stream running about east and west, it ranged in Van Buren and Henry counties, four and one-half miles north and a little east of Hillsboro" (W. G. Savage). Webster—"a specimen was seen around Duncombe's Stucco Mill (Ft. Dodge) nearly every day, and I finally shot him a mile further down the stream (Des Moines River); length 14.5 inches; dark bluish, grayish to slate color; tail nearly black" (Somes). Woodbury—"according to D. H. Talbot, formerly visited this county" (Rich).

Genus CIRCUS Lacépède.

137. (331). *Circus hudsonius* (Linn.). Marsh Hawk.

The Marsh Hawk or Harrier is a common summer resident in most parts of the state, nesting most frequently in northern Iowa, and is given as a rare winter resident in Lee county (Currier). It is a low-flying Hawk, hovering low over the meadows, and may be identified by the conspicuous white rump. Its food consists almost entirely of field mice and gophers or ground squirrels, of which it kills large numbers. C. F. Henning states that the stomach and throat of a Marsh Hawk collected Oct. 20, 1890, contained three adult and eight young field mice. Small birds are very seldom molested and Mr. J. W. Preston notes a female Marsh Hawk and a Prairie Hen incubating their eggs on nests not eight feet apart (Bendire, Life Hist., 91).

In Winnebago and Hancock counties the Marsh Hawk arrives about the middle of March and leaves the last of November. I have found nests from May 13 to June 2, placed on dry ground on the open prairie, either meadows or hillsides, in brushy clearings, or over open water in sloughs; eggs three to five; pale blue, normally unspotted.

Dr. A. K. Fisher states: "Of 124 stomachs examined, 7 contained poultry or game birds; 34, other birds; 57, mice; 22, other mammals; 7, reptiles; 2, frogs; 14, insects; 1, indeterminate matter, and 8 were empty" (Hawks and Owls of the U. S., 27).

Genus ACCIPITER Brisson.

138. (332). *Accipiter velox* (Wils.). Sharp-shinned Hawk.

This small and dashing Hawk is a common spring and fall

migrant in nearly all parts of the state, and a few observers report it as an uncommon summer resident in the northern part of the state. It is more injurious than most Hawks, feeding principally on small birds. "Little can be said in favor of this Hawk. . . . Of 159 stomachs examined, 6 contained poultry or game birds; 99, other birds; 6, mice; 5, insects; and 52 were empty (Fisher, Hawks and Owls, 33-37).

There are a few nesting records from Iowa. "Mr. Lynds Jones of Grinnell, Iowa, has found eggs of this species on May 2, and writes me that 'in this locality they breed occasionally in hollows of American Lindens, and in such cases the nest is made of the inner bark of this tree, and of the wild grape vine, with a lining of grass and feathers. When built in a tree (an open nest) sticks are used. It generally chooses limbless trees, most frequently oaks, to nest in, from 15 to 20 feet up.'" (Bendire, Life Hist. of N. A. Birds, 1892, 189).

W. H. Bingaman writes: "Breeds in the timber south of here (Algona, Kossuth county), generally among the thick second-growth burr-oaks, usually at the very top branches. Of course it is not common—about one set every two years." Dr. C. C. Smith gives it as a "not uncommon summer resident in Winneshiek," and H. J. Giddings as a "common summer resident" in Jackson. Shoemaker lists it as a common migrant and uncommon summer resident (Franklin), and Henning as a fairly common summer resident (Boone). J. Eugene Law took a set of eggs near Lake Mills (Winnebago) in the spring of 1893.

139. (333). *Accipiter cooperi* (Bonap.). Cooper Hawk.

The Cooper Hawk or "Blue Hen-hawk" is a common summer resident in all parts of the state. Its habits are much like the preceding species, which it much resembles, and owing to its larger size is much more destructive to poultry and game birds. It probably destroys more poultry than all of the larger "Hen-hawks" together. "Of 133 stomachs examined, 34 contained poultry or game birds; 52, other birds; 11, mammals; 1, frog; 3, lizards; 2, insects, and 3 were empty" (Fisher).

The Cooper Hawk nests usually in small or second-growth timber, generally not over thirty feet from the ground, and frequently very close to farm-houses or barns. The bird is so quiet

and wary that its daring proximity is often not suspected. The eggs are usually laid in the early part of May, in an open nest composed of sticks and small twigs, frequently unlined.

Subgenus ASTUR Lacépède.

140. (334). *Accipiter atricapillus* (Wils.). American Goshawk.

The American Goshawk is a rather rare and somewhat irregular winter resident in Iowa. It occurs from November to April, and has been recorded from most sections of the state. It is a handsome species, bold and dashing in its habits, feeding principally upon game birds, rabbits, etc. It is usually found in or near the woods. W. H. Bingaman reports it as "quite common in winter" (Kossuth). A specimen in my collection was taken in January, near Forest City (Winnebago).

Genus PARABUTEO.

141. (335). *Parabuteo unicinctus harrisi* (Aud.). Harris Hawk.

This strikingly marked Hawk is an inhabitant of the southern border of the United States from Mississippi to Lower California, and south to Panama. Its admission to the Iowa list is based upon a single specimen captured in Van Buren county, near Hillsboro. Walter G. Savage writes concerning it, February 25, 1904: "Nine years ago a trapper caught one in a steel trap and brought it to me. This is the only one that I can positively identify in our locality. My father took this Hawk and now has a fine painting from it, true to nature. It is identical with your description, and also Coues'. It is surely a Harris Hawk."

Genus BUTEO Cuvier.

142. (337). *Buteo borealis* (Gmel.). Red-tailed Hawk.

The Red-tailed Hawk, the common "Hen-hawk," is a common summer resident and breeds in all parts of the state. South of the middle line of the state the Red-tail is generally resident throughout the year; at least many individuals remain during the winter except during very severe weather. They become common in all sections by the latter part of February or first of March, and the eggs are laid by the first of April (sometimes early in March) in southern Iowa, while in the northern part of the state sets are rarely completed before the last week of April

or first of May. The nest is a bulky mass of sticks and twigs, placed near the top of a large tree, and is frequently used year after year.

"Of 562 stomachs examined, 54 contained poultry or game birds; 51, other birds; 278, mice; 131, other mammals; 37, batrachians or reptiles; 47, insects; 8, crawfish; 1, centipede; 13, offal; and 89 were empty." (Fisher). Contrary to the popular belief, the Red-tail very seldom visits poultry-yards, and its food-habits should cause it to be protected by the agriculturist rather than persecuted.

I examined a specimen in the collection of Dr. B. H. Bailey, taken at Clear Lake, Iowa, in July, 1892, which was changing from juvenile to the adult plumage. Most of the tail feathers were of the grayish barred type, but some were of the red adult phase. One red tail-feather was only half grown out. W. G. Savage reports that an apparently snow-white Red-tail was seen near Hillsboro (Osprey, 1, 10, 136). The Red-tail shows great variability in the shades of its plumage, hardly two specimens being found exactly alike.

143. (337a). *Buteo borealis krideri* Hoopes. Krider Hawk.

The Krider Hawk is a paler phase of the Red-tailed Hawk; chiefly inhabiting the Great Plains, but occurring quite commonly in Iowa. It is similar to *B. borealis* but has much more white in the plumage, under parts only lightly streaked and the tail pale rufous, usually without a subterminal black band. This variety was described by Bernard A. Hoopes from specimens collected in Winnebago county, Iowa, Septeniber, 1872, by John Krider (Proc. Phila. Acad., 1873, p. 238, pl. 5; *Forest and Stream*, i, 10, 1873, 150). Krider says (Forty Years' Notes, 1879, 7): "This bird I have found in Winnebago county, Iowa, in 1870. I first observed it flying at a distance, and at first took it for an albino, but seeing several of them in company together, was very anxious to secure one. . . . I was able to get one that was shot by Mr. Hill, a farmer in the county. . . The second bird was watching a flock of prairie chickens. The third specimen I obtained in 1873, in the same county, and in 1874 I found in the same place quite a number, but could not get near them. . . . The first two specimens are in the Academy of Natural Sciences of Philadel-

phia. This bird was described and named by B. A. Hoopes, Esq."

May 14, 1895, I took a set of two eggs, advanced in incubation, together with female parent, in Winnebago county. The bird was identified by Robert Ridgway and is now in the Smithsonian Institution (Accession 30869). The nest and eggs did not differ materially from those of the common Red-tail. May 2, 1896, took three slightly incubated eggs in Hancock county; nest in a burr-oak, 65 feet from the ground, composed of sticks and one corn-stalk, lined with strips of stringy bark. The nest also contained a number of White Poplar twigs with young green leaves. April 27, 1897, three eggs, slightly incubated; May 1, 1897, three eggs, slightly incubated, female bird shot (Hancock county).

County records: Kossuth—"common; breeds" (Bingaman). Hardin—"this ill-defined variety not rare in Hardin county, where the type is specially abundant" (Peck). Lee—"rare resident; breeds" (Praeger). Linn—"rare summer resident" (Berry). Warren—"tolerably common resident" (Jeffrey). Webster—"rare" (Somes). Winnebago—"summer resident" (Halvorsen).

144. (337b). *Buteo borealis calurus* (Cass.). Western Red-tail.

The typical Western Red-tail is chocolate-brown or darker, quite unicolor, with rich red tail crossed by several black bars; from which phase it grades insensibly into the ordinary *borealis* type. Kumlien and Hollister report it as of "rare but regular occurrence in Wisconsin in the late fall" (Bds. of Wis., 1903, 63). In Nebraska, "during migrations, straggling over entire state . . . Omaha, etc." (Rev. Bds. Neb., 1904).

A male in the Coe College collection, taken at Cedar Rapids in 1902, was pronounced by Prof. Charles R. Keyes to be darker than many specimens he had observed in California.

County records: Linn—"summer resident; nests" (Bailey). Polk—"rare summer resident; nests. Have found but one nest in Iowa. That was in a quite large piece of timber southeast of here near the Des Moines River; shot one of the birds. This was about 1898" (Johnson). Van Buren—"rare fall migrant" (Savage). B. H. Wilson records a specimen from Rock Island, Ill.

145. (338). *Buteo borealis harlani* (Aud.). Harlan Hawk.

The Harlan Hawk or Black Hawk is a sooty or black phase of the *borealis* group, of which *krideri* represents the opposite

extreme. Its range is generally given as "Gulf States and lower Mississippi Valley; north (casually) to Kansas, Iowa, Illinois and Pennsylvania."

Robert Ridgway states in an article, "Harlan's Hawk a Race of the Red-tail, and not a distinct species" (Auk, vii, 1890, 205): "An adult specimen belonging to the Iowa College museum, Grinnell, Iowa, which Dr. Merriam has kindly submitted to me for examination, is so clearly intermediate between *B. harlani* and *B. borealis* that I have no longer any doubt that the former is simply a peculiar variation of the latter, in which the coloration of the tail is chiefly affected. In this Iowa specimen the plumage is in every respect, except the tail, that of typical *B. borealis*, while the tail has the curious mixed coloration so characteristic of the so-called *B. harlani*."

County records: Blackhawk—"migrant" (Walters). Linn—"spring and fall migrant" (Bailey). Webster—"rare" (Somes). Woodbury—specimens taken at Sioux City by D. A. Talbot, showing strong melanistic character (Auk, vii, 1890, 285). Winnebago—two specimens are in my private collection, one brought to me Oct. 27, 1891, and another which I shot along the bed of Lime Creek north of Forest City, Nov. 5, 1898.

146. (339). *Buteo lineatus* (Gmel.). Red-shouldered Hawk.

The Red-shouldered Hawk is a tolerably common summer resident in the southern part of the state, particularly in the southeastern portion; rare in the northern portion, and not reported from the western part of the state. Currier reports it as a "common resident" in Lee county and Savage does the same in Van Buren county, while Henning states that it is "occasionally met with throughout the year" in Boone county. It probably occurs along the Missouri River in Iowa, as it is reported from Nebraska as "not uncommon in the eastern part of the state, where it breeds abundantly along the Missouri River bluffs—Omaha, Bellevue, etc." (Rev. Bds. Neb., 51). I never observed the species in either Hancock or Winnebago counties, although I studied Hawks extensively in that locality. M. E. Halvorsen, however, reports that he has observed it at Forest City, and W. H. Bingaman reports it as rare in Kossuth county. It is generally reported from southern and eastern Iowa, where it is said to elude observation by keeping strictly to heavy timber in bottom lands.

Dr. A. K. Fisher states: "The diet is probably more varied than that of most birds of prey . . . the writer in his field experience has never seen one attack a fowl, nor has he found the remains of one in the stomachs of those examined. . . . Of 220 stomachs examined, 3 contained poultry; 12, other birds; 102, mice; 40, other mammals; 20, reptiles; 39, batracians; 92, insects; 16, spiders; 7, crawfish; 1, earthworm; 2, offal; 3, fish; and 14 were empty" (Hawks and Owls of the U. S., 62–70).

Subgenus TACHYTRIORCHIS Kaup.

147. (342). *Buteo swainsoni* Bonap. Swainson Hawk.

The Swainson Hawk is probably the commonest Hawk in most parts of the West, rarely coming east of the Mississippi. It is fairly well distributed over Iowa as a migrant and nests from the central to the northern portions of the state. The Swainson Hawk nests somewhat later than the Red-tail,—in the early part of May in northern Iowa. The nest is built in the small remnants of native groves, or moderately timbered tracts, and the bird seems quite careless about its concealment. Almost invariably fresh sprigs of green leaves are found in nests containing eggs. May 16, 1894, I found a pair occupying an old nest of the preceding year, in an oak, about fifty feet from the ground. The nest contained three fresh eggs. A dead green snake about fifteen inches long hung on a limb about a foot below the nest. One of the Hawks was sitting on a dead tree not far off, and the other remained on the nest until I had climed up several feet. May 14, 1895, I found two considerably incubated eggs; May 18, 1897, four fresh eggs (Hancock). May 4, 1897, found a nest just completed, but the nest was destroyed after the eggs were laid, and an entirely new nest was built near by which contained two eggs on May 18 (Winnebago).

Fisher describes the food as "extremely varied, but consists of more insect matter than is usually the case in birds of prey of this group. . . . of 18 stomachs examined, 7 contained small mammals; 8, insects; 3, reptiles; 3, batracians; and 3 empty. . . . of 65 stomachs examined, 2 contained small birds; 15, mice; 13, other mammals; 11, reptiles; 13, batracians; 30, insects; 2, earthworms; 4, crawfish, and 7 were empty" (Hawks and Owls, 72).

Subgenus BUTEO Cuvier (part).

148. (343). *Buteo platypterus* (Vieill.). Broad-winged Hawk.

The Broad-winged Hawk appears to be somewhat irregularly distributed in Iowa, as a number of observers fail to report its occurrence, some report it as a common migrant, and others as rare. W. H. Bingaman reports it as "common; a few breed" (Kossuth). In Winnebago county I have found it common in spring and fall and rare in summer. J. Eugene Law took a set of eggs near Lake Mills (Winnebago) in the latter part of May, 1893. The Broad-wings are rather sluggish in their movements, and are very tame and unsuspicious in the spring. A man may frequently approach within easy gunshot range, and when the Hawk is scared up it usually flies only a short distance and alights in another tree. J. W. Preston took a melanistic female specimen near Crystal Lake, Hancock county, May 3, 1883; described by R. Ridgway (Proc. U. S. Natl. Mus., ix, 1886, 248–9).

Dr. Fisher says: "The only act of the Broad-winged Hawk which seems injurious to agriculture is the killing of toads and small snakes, the former of which are exclusively insect-eaters, the latter very largely so. In one respect its enormous value ranks above all other birds, and that is the destruction of immense numbers of injurious larvæ of large moths, which most birds are either unable or disinclined to cope with."

Genus ASTURNIA Vieillot.

149. (346). *Asturnia plagiata* Schleg. Mexican Goshawk.

This is a species of Mexico and the southwestern United States, said to straggle up the Mississippi Valley to southern Illinois. There is but one Iowa record (Iowa Orn., i, 4, 1895, 89): "Walter G. Savage of Hillsboro feels proud over securing a female specimen of Gray Star Buzzard, on May 25, 1895, in Van Buren county, Iowa, near his home." In a letter, Mr. Savage says: "In 1895 I shot a pair of these, the only ones that I ever knew of occurring in our locality—Mexican Goshawk is Gray Star Buzzard. I have the skins of two of these Hawks, and am positive of identity; killed in Van Buren county, on Big Cedar."

Genus ARCHIBUTEO Brehm.

150. (347a). *Archibuteo lagopus sancti-johannis* (Gmel.) American Rough-legged Hawk.

The two species of Rough-legged Hawks are characterized from the other Hawks by the tarsi being feathered to the toes. The American Rough-legged Hawk is a large dusky-colored Hawk which occurs quite commonly in all sections of the state as a winter resident, arriving in October or November and departing in March. Reported by most observers.

"Of 49 stomachs examined, 40 contained mice; 5, other mammals; 1, lizard; 1, insects; and four were empty" (Fisher).

This species varies much in coloration, from dark brown or blackish to specimens tinged with much rufous or ochraceous, which latter approach to *A. ferrugineus*, but are distinguishable by a smaller bill and narrower gape.

151. (347a). *Archibutea ferrugineus* (Licht.). Ferrugineous Rough-leg.

The Ferrugineous Rough-leg occurs occasionally in Iowa during the migrations. It is a bird of the western United States, occasionally straggling east to Iowa or even to Illinois and Wisconsin. Major Bendire states (Life Hist. of N. A. Birds, 259–60) that it "has been reported as nesting near Grinnell, but the record has not been fully verified." Mr. Lynds Jones says of this: "I know nothing about the Ferruginous Rough-leg at Grinnell. Bendire concluded that the Grinnell bird must be Ferruginous, and so stated upon his own motion. I always questioned it." In Nebraska it is "the common Rough-legged Hawk in the state, and occurs throughout. It is less common in the eastern portion" (Rev. Bds. Neb., 1904, 52).

County records: Blackhawk—"rare winter visitant; specimen in museum of I. S. N. S." (Walters). Kossuth—"a few seen. I am sure of identity of this species, as it is well known to me" (Bingaman). Linn—"a pair of Ferruginous Rough-legs winter every year at Gordon's grove, Waubeck; have seen them there four different years. They are larger birds than the Swainson, but are white or nearly so below, with feathered legs. Mr. J.W. Preston collected a set of Ferruginous Rough-leg near Newton" (Berry). Pottawattamie—"straggler" (Trostler). Woodbury—"rare; it is not uncommon in the various mounted Hawks seen in the stores of Sioux City. I have never handled a fresh specimen" (Rich).

Genus AQUILA Brisson.

152 (349). *Aquila chrysäetos* (Linn.). Golden Eagle.

The Golden Eagle is a rather rare but fairly regular visitor to Iowa, at least specimens are killed in different parts of the state nearly every year. It is sometimes taken in winter, although most of the specimens are observed in March and April and in October. It does not breed in the state, and its wanderings seem to follow the migrations of the other birds, waterfowl, etc., which form the bulk of its food.

"It may be stated that in sections of the country where rabbits, prairie dogs or gophers are abundant the Golden Eagle is very beneficial, confining its attention mainly to these noxious animals; but in places where wild game is scarce it is often very destructive to the young of domesticated animals" (Fisher). One stomach which I examined, taken in Hancock county, contained several large frogs, and others contained the remains of rabbits.

The Golden Eagle seems to have been more abundant in the early days. Thomas Say mentions its occurrence at Engineers' Cantonment in 1819–20, as Falco (*Aquila* Briss. *fulvus*), "Ring-tailed Eagle Wilson; War-eagle of the Omawhaws" (Long's Exp.). Keyes and Williams state that several were taken in the eastern part of the state in 1886. Cooke states that "several were seen and some captured in central and northern Iowa in the winter of 1883–84, the last ones leaving from March 15 to 22" (Bird Migr. in Miss. Val., 107–8). C. F. Henning writes that it was fairly common in the early days, but he has had several fine specimens brought to him during the past ten years. Some of the more recent specimens which I have handled in the flesh were taken as follows: December 7, 1900, Davis City, Iowa, taken by Guy Bailey; April 14, 1903, by Dr. J. H. McKay; October 25, 1904, Iowa City; March 16, 1905, six miles south of Iowa City. The Golden Eagle may be known from the Bald Eagle in any plumage by having the tarsus feathered to the toes.

Genus HALIÆETUS Savigny.

153. (352). *Haliæetus leucocephalus* (Linn.). Bald Eagle.

The Bald Eagle has been characterized by Dr. Coues: "North America, anywhere, common—for an Eagle; piscivorous; a piratical parasite of the Osprey: otherwise notorious as the emblem of

the republic." The Bald Eagle was formerly common in Iowa and frequently nested in favorable localities. At the present time it can only be considered as tolerably common along the larger water-courses during migrations, and occasionally during the winter. A nesting pair is of very exceptional occurrence in the state.

Prince Maximilian (Reise, i, 282) states (April 25, 1833): "Der Canal zwischen der genannten Insel and dem Festland wird Nadaway-Slew genannt. . . . Der weissköpfige Adler (Bald Eagle) nestete häufig auf hohen Bäumen am Ufer." He also noted a nest above the mouth of Wolf River and observed the birds above the Nishnabotna River. These notes were made along the Missouri a short distance below the southwestern corner of Iowa.

In his "Life Histories of North American Birds" (Plate ix, fig. 7), Major Bendire figures an egg of the Bald Eagle, from a set of two obtained at Alden, Iowa, April 18, 1873, and which was slightly incubated when found. Chas. R. Keyes writes: "The birds occasionally shot are, as a rule, young. Bred along the Cedar River near Mt. Vernon twenty-five years ago. No recent records of breeding here" (Linn). M. E. Peck states that it bred sparingly in Blackhawk county thirty-five years ago. The only report of nesting within recent years comes from J. L. Sloanaker of Newton (Jasper county), who writes: "I know where a Bald Eagle recently nested near Kellogg. Eagles have been taken here every summer past for several years. One firm here had a large cage with three young in it last summer (1905), two of them captured near Kellogg. . . . Moreover, old Eagles have been seen at Kellogg in June and July. They used to nest there several years ago. Carl Kelsey's old chum collector said that they had taken eggs at Kellogg at a certain bluff near town."

Subfamily FALCONINÆ.

Genus FALCO Linnæus.

Subgenus HIEROFALCO Cuvier.

154. (355). *Falco mexicanus* Schleg. Prairie Falcon.

The Prairie Falcon is an inhabitant of the Western Plains and is only an occasional visitant in Iowa. W. W. Cooke (Bird Migr. in Miss. Val., 1884–85, 118) states: "It has been found in central Iowa and as far east as Illinois."

County records: Blackhawk—"one specimen taken in Blackhawk county many years ago by George D. Peck" (M. E. Peck). Buena Vista—"Storm Lake, Iowa, Frank Bond. Specimen in University museum"—No. 3576, male (C. C. Nutting, Proc. Iowa Acad. Sci., 1892, 41). Lee—"a rare visitant" (Currier). Linn—"rare; occasional visitant" (Berry). Mills-Pottawattamie—"rare migrant. Though I have seen this species a number of times in Pottawattamie and Mills counties, the only notation of date I have is July 4, 1892, one killed at Honey Creek Lake while trying to catch young Mallard ducks. I have seen it in Mills county during the last five years, in the spring time (April), but have no exact notations" (Trostler). Sioux—"shot male at Hawarden, in 1890" (Berry).

155. (356). *Falco peregrinus anatum* (Bonap.). Duck Hawk.

The Duck Hawk or Peregrine Falcon inhabits all of North America and the greater part of South America but can nowhere be considered common. It is reported as a rare migrant from several stations in Iowa, and as a rare summer resident in a very few favorable localities.

Wm. Wood, M. D., in an article on "The Game Falcons of New England" (Am. Nat., v, 1871, 83), says: "I do not find the duck hawk included in Mr. J. A. Allen's list of the birds of western Iowa, yet Mr. L. E. Ricksecker writes me that he has a fine specimen of the eggs, collected in Iowa, March 21st, 1868." H. W. Parker also records it from Clinton county (Ibid., 169).

Geo. H. Burge (Iowa Orn., ii, 2, 14-19) describes the nesting of the Duck Hawk on cliffs of the Cedar River about fifteen miles below Cedar Rapids. He was told by an old hunter who has lived along the river for about twenty-five years, that there had been a pair of them there ever since he had been there, usually arriving about the middle of March. He took his first set of four eggs, April 28, 1892, from a hole in the face of bluff about eighty feet from the water and twenty feet from the top of the bluff; second set May 27, 1892, in same place. In 1893 the eggs were hatched. In 1894 , four eggs were taken April 20, and a second set on May 2, by B. H. Bailey—three eggs. Dr. Bailey continues the history of this pair ("The Duck Hawk in Iowa," Proc. Iowa Acad. Sci., x, 1902, 93-98), which nested every year along

the "Palisades" of the Cedar River, extending in the southeastern part of Linn county, and the northeastern part of Johnson county. The birds seemed to cling to their nesting place with remarkable persistency, and when robbed of the first set of eggs, would lay another in the immediate vicinity. Dr. Bailey states that the Duck Hawks nested there until 1898. May 1, 1897, four fresh eggs were taken.

In 1898, the last set of eggs was taken from this pair of birds, six fresh eggs, on April 6, at the old nesting site at the Upper Palisades, in the upper cliff. A second set was laid some distance below and on the opposite side of the river, and the young were allowed to hatch, but were killed before reaching maturity. Since then none of this species have been seen in the vicinity of the Palisades. Dr. Bailey describes a series of thirty-three eggs taken in this locality: two sets of six, one of five, and four of four each, varying from almost unmarked specimens to eggs which show almost no trace of the ground color and whose spots are in places almost black. In no case where a second set was laid did the number exceed three.

County records: Blackhawk—"rare migrant" (Walters); "a regular but infrequent migrant in Blackhawk county, where it once bred sparingly, on one occasion occupying a deserted nest of the Bald Eagle" (Peck). Des Moines—Mus. No. 16159, male, Burlington, Sept. 8, 1894, Paul Bartsch. Jackson—"tolerably common migrant" (Giddings). Lee—"scarce migrant" (Praeger); "migrant, not common" (Currier). Linn—"formerly bred on cliffs along the Cedar River" (Keyes). Winnebago—"migrant at Forest City; at Coon Grove, in 1903, watched one catch a duck in the air and then eat it" (Halvorsen).

Subgenus TINNUNCULUS Vieillot.

156. (357). *Falco columbarius* Linn. Pigeon Hawk.

The Pigeon Hawk is tolerably common during the migrations in Iowa and has very rarely been known to nest in the state. Major Bendire, in his "Life Histories of North American Birds" (p. 299), says: "Mr. Lynds Jones writes me that he found a nest of this species near Grinnell, Iowa, on April 28, containing four eggs. They were placed in a hole in an American Linden tree, about eight feet from the ground. The nest was made of dry

grasses, fibrous bark, and a few feathers. The birds hovered near when the nest was disturbed, but did not offer any resistance. Mr. J. W. Preston of Baxter, Iowa, informs me that a pair of these birds remained one season near Iowa City under circumstances which led him to believe they were nesting." Mr. Jones corroborates this record in a recent letter. Dr. Trostler records the species as a straggler in Pottawattamie county. He says: "I removed an egg from a female bird shot near Sioux City some years ago; egg now in the National Museum."

Currier records it as a common migrant, occasionally seen in winter, in Lee county. In Winnebago county I have found it only as a rare migrant, but shot one bird December 18, 1894. Other observers report the Pigeon Hawk only as a spring and fall migrant, usually in March, April, and October.

157. (358). *Falco richardsoni* Ridgw. Richardson Merlin.

The Richardson Merlin very closely resembles the Pigeon Hawk but has a more restricted range in North America and is rare east of the Mississippi. There are only a few casual records from Iowa. It has been taken at West Point and Omaha, Neb., by Bruner (Rev. Bds. Neb., 1903).

County records: Blackhawk—"an accidental visitor has been recorded from La Porte City, Iowa" (Cooke, Bird Migr. in Miss. Val., 1884–85, 119); "an accidental specimen taken in Blackhawk county by George D. Peck" (Morton E. Peck). Buena Vista—"Storm Lake, Iowa. Frank Bond. Specimen in University museum" (C. C. Nutting, Proc. Iowa Acad. Sci., 1892, 41).

Subgenus CERCHNEIS Boie.

158. (360). *Falco sparverius* Linn. American Sparrow Hawk.

The American Sparrow Hawk is a common migrant in all parts of the state and somewhat less common as a summer resident, although found nesting in all suitable localities. The nest is usually placed in a hollow of a tree or a deserted woodpecker's hole, but Lynds Jones has found them breeding in open nests at Grinnell, usually old Crows' nests, using very little new material in remodeling the nest (Bendire, Life Hist., 310–11). The Sparrow Hawks arrive from the south in March or April and remain until late in the fall. A male specimen was shot at Iowa City, Novem-

ber 28, 1905. In autumn, numbers are often seen perched upon telegraph wires along the railroads.

"Of 320 stomachs examined, 1 contained a game bird; 53, other birds; 89, mice; 12, other mammals; 12, reptiles or batrachians; 215, insects; 29, spiders; and 29 were empty. . . . The Sparrow Hawk is almost exclusively insectivorous, except when insect food is difficult to obtain" (Fisher, Hawks and Owls). Grasshoppers form a favorite article of diet when obtainable.

Subfamily PANDIONINÆ. Fish Hawks.

Genus PANDION Savigny.

159. (364). *Pandion haliætus carolinensis* (Gmelin). American Osprey.

The American Osprey or Fish Hawk appears to be only a spring and fall migrant in Iowa, rather rare in general, but sometimes tolerably common along the larger water-courses. Keyes and Williams classed it as a rare summer resident (Birds of Iowa, 1889, 128). "It formerly bred along the Missouri River near Rockford, where Bruner observed birds carry food to the nest" (Rev. Bds. Neb., 1894, 53). There are skins in the University museum collection taken in the vicinity of Iowa City, Clermont, and Sioux City. September 21, 1894, I mounted a female specimen killed at Lake Edwards, Hancock county, by Rev. Jas. P. Taken. The food of the Osprey consists almost entirely of fish, which it generally captures alive.

Suborder STRIGES. Owls.

Family STRIGIDÆ. Barn Owls.

One species of this family is represented in Iowa. It is characterized by having the facial disc well developed and sub-triangular in shape, and the inner edge of middle claw usually (but not invariably) serrate or pectinate.

Genus STRIX Linnæus.

160. (365). *Strix pratincola* Bonap. American Barn Owl.

The American Barn Owl, or "Monkey-faced Owl," is a rather rare resident in the southern half of the state, and very rarely appears north of the middle line of the state. Dr. Fisher says:

"It migrates more or less in the northern parts of its range, and there is an appreciable increase in the number of individuals to the southward during the fall months. . . Of 39 stomachs examined, 1 contained poultry; 3, other birds; 17, mice; 17, other mammals; 4, insects; and 7 were empty" (Hawks and Owls of the U. S., 132).

County records: Blackhawk—"rare resident" (Salisbury, Walters); two nests found in hollow trees in Blackhawk county" (Peck). Boone—"rarely seen" (Henning). Cass—Pellett. Des Moines—"rare" (Matson); female taken at Burlington Nov. 23, 1895, by Paul Bartsch. Franklin—"noted once only" (Shoemaker). Johnson—"several seen near Iowa City, December, 1876, by John Williams" (Nutting, Proc. Iowa Acad. Sci., 1892); mounted a female shot near Morse, Dec. 4, 1903 (Anderson). Lee —"accidental" (Praeger); "rare visitant" (Currier). Linn—"a pair used to breed in abandoned grain shoots or ventilators of our old stone mill. This was from about 1890–93" (Keyes); "occasional" (Bailey); "rare resident" (Berry). Polk—"rare resident; nests" (Johnson). Webster—"few" (Somes). Poweshiek—"rare accidental visitor" (Kelsey). Woodbury—"uncommon summer resident; breeds" (Rich). Wayne—(Brown).

Family BUBONIDÆ. Horned Owls, etc.

The Owls are mostly woodland birds and with few exceptions are nocturnal birds of prey. For this reason they feed more largely on the smaller mammals and are therefore of even greater value to the farmer than the Hawks. The structure of the Owls is much like that of the Hawks, but the plumage is softer and looser in texture, rendering the flight noiseless. The outer toe is more perfectly reversible. The eggs of the Owls are uniformly white and sub-spherical in shape.

Genus ASIO Brisson.

161. (366). *Asio wilsonianus* (Less.). American Long-eared Owl.

The American Long-eared Owl is a tolerably common resident in most parts of the state, appearing to be rare in a few localities. It is more strictly nocturnal in its habits than most of the Owls, and usually spends the day hidden in thick evergreens or dense shrubbery. The Long-eared Owl lays its eggs, five to seven in

number, in an open nest, usually the deserted nests of Crows, Cooper Hawks, or squirrels, from fifteen to thirty-five feet from the ground, from the last of March to the middle of April.

Fisher states that it is "one of our most beneficial species, destroying vast numbers of injurious rodents and seldom touching insectivorous birds. . . . Of 107 stomachs examined, 1 contained a game bird; 15, other birds; 84, mice; 5, other mammals; 1, insects; and 15 were empty" (Hawks and Owls).

The species may migrate to some extent. I have found it much less common in winter in Winnebago county than at other seasons. At Davenport, B. H. Wilson gives it as more abundant in winter than in summer; colonies of a dozen or more winter together in evergreens in the cemeteries.

The Long-eared Owl generally builds its nest in rather open, second-growth timber, frequently in a small tree overgrown with wild grape vines or ivy. When disturbed on the nest this Owl has the habit of snapping its mandibles together with a sharp, clicking sound.

162. (367). *Asio accipitrinus* (Pall.). Short-eared Owl.

The Short-eared Owl is a tolerably common resident in most parts of the state, but becomes much more common during the winter months. It differs in habits from most Owls, living upon the marshes and prairies and very seldom entering woodland. It is quite diurnal in habits, and is often seen hawking for field mice low down over the grass tops. When alert and on the open prairie it is very wary and difficult to approach, although the bird is frequently flushed from the slough grass almost at one's feet.

"Fully 75 per cent of the stomachs examined by the Department of Agriculture contained mice. The remains of as many as six of these little animals were found in one stomach, and several contained three or four each. Prof. F. E. L. Beal reported finding nothing but mice in the stomachs of a pair which he killed in Story county, Iowa. They were shot in an artificial grove swarming with small birds." . . . A specimen killed in Hancock county, Iowa, July 15, 1889, contained 2 meadow mice and 2 shrews (Fisher, Hawks and Owls).

In Winnebago county I have found the Short-eared Owl very abundant during some winters and rare during others. It is a

rather rare summer resident. A set of six eggs in my collection was found by M. E. Halvorsen, May 16, 1896, near Forest City. The nest was on the ground in a nearly dried marsh, placed between two bog clumps of earth; composed of a few blades of grass and some feathers.

Genus SYRNIUM Savigny.

163. (368). *Syrnium vorium* (Barton). Barred Owl.

The Barred Owl, or "Hoot Owl," is a tolerably common resident in Iowa, particularly in the eastern part of the state, wherever there are considerable tracts of heavy timber. Their weird, sonorous, and often-repeated note of *whoo-whoo-whoo*, with many variations, has earned for them the common name of Hoot-owls. This hooting sometimes sounds like a hollow laugh, dying away in a mournful wail. The effect is often startling. The nest is usually in a hollow tree or stub, very rarely an open nest, and the eggs are generally laid in the latter part of March or in April. A very early record is given by Bendire: "The type specimen (egg) No. 20633, Bendire collection, from a set of three, was taken by Mr. G. Peck in Blackhawk county, Iowa, March 2, 1878. It is figured on plate xii, fig. 4" (Life Histories of N. A. Birds, 336).

"Of 109 stomachs, 5 contained poultry or game; 13, other birds; 46, mice; 18, other mammals; 4, frogs; 1, a lizard; 14, insects; 2, spiders; 9, crawfish, and 20 were empty. . . . If a fair balance be struck, therefore, it must be considered that this Owl is on the whole beneficial, and hence should occupy a place on the list of birds to be protected" (Fisher, Hawks and Owls, 150–55).

Genus SCOTIAPTEX Swainson.

164. (370). *Scotiaptex nebulosa* (Forster). Great Gray Owl.

The Great Gray Owl is a resident of the far north and only occurs in Iowa as a casual straggler in winter. It was listed by J. A. Allen in White's Geology of Iowa, 1870 (p. 424), and it has been "reported on Dec. 17, 1893, near Omaha, by I. S. Trostler" (Rev. Bds. Neb., 55). T. M. Trippe records (Proc. Bost. Soc., xv, 1872, 233): "Syrnium cinereum. A very large bird was killed at Oskaloosa, in Mahaska county, which, from the description given me by the person who shot it, must have been this species."

Walter G. Savage writes from Hillsboro, Van Buren county:

"In 1860 my father shot one. I have not known them to occur since. There is no mistake in this owl. My father shot it in a tree standing in our dooryard one night, and it was nothing else but a Great Gray Owl." David L. Savage, writing in 1894, says: "A friend in Van Buren county shot a Great Gray Owl a few winters ago. This is the only time I ever heard of this species being found in Iowa, but the identity is certain."

Genus CRYPTOGLAUX Richmond.

165. (372). *Cryptoglaux æcadica* (Gmel.). Saw-whet Owl.

The little Saw-whet or Acadian Owl is generally distributed throughout the state, being most frequently observed in winter, although a few observers report it as a rare resident. It seems to be somewhat irregular in its occurrence, being tolerably common at times and then not seen again in the same locality for several years. More specimens have been taken in October and November than any other months.

"It is known to breed quite regularly across the river from Omaha and probably does on the Nebraska side also" (Rev. Bds. Neb., 1904, 55). Dr. Trostler also records it as a scarce summer resident in Pottawattamie county. D. L. Savage writes: "The 6th of May, 1893, while out in the woods, I shot a female Saw-whet Owl, the first one I have found in this county" (Henry).

On March 16, 1893, some boys presented me with a live Saw-whet Owl which they had caught alive two days before, near Forest City, as it dozed on the limb of a low tree. I kept it in captivity eight months and found it unusually mild-tempered, never attempting to bite or scratch. From the first day I got it the owl would take birds or mice from my hands and eat them. Frequently during the night its querulous whistle could be heard repeated again and again. Another was captured which had flown against a store window, Nov. 6, 1894.

"Of 22 stomachs examined, 17 contained mice; 1, a bird; 1, an insect, and three were empty" (Fisher).

Genus MEGASCOPS Kaup.

166. (373). *Megascops asio* (Linn.). Screech Owl.

The Screech Owl is by far the commonest Owl in Iowa, being found throughout the year in all parts of the state. It occurs

in two distinct phases of coloration, the red and the gray, both being about equally numerous. The color phases are not dependent upon age, sex, or season, and both phases are sometimes represented in the same brood. The nest is placed in a natural hollow of an old tree, frequently in an old apple orchard. The nesting time is usually in April, but is somewhat irregular. April 27, 1895, I found a nest in the top of a dead basswood stub near Forest City, thirty feet from the ground, containing five fresh eggs, while another nest, a short distance from the first, contained five young birds on April 27, 1896. The Screech Owl frequently comes into towns, and its weird, tremulous, wailing whistle may often be heard at night from the shade trees at our doors.

"Of 225 stomachs examined, 1 contained poultry; 38, other birds; 91, mice; 11, other mammals; 2, lizards; 4, batrachians; 1, fish; 100, insects; 5, spiders; 9, crawfish; 7, miscellaneous matter; 2, scorpions; 2, earthworms; and 43 were empty. . . . At nightfall they begin their rounds, inspecting the vicinity of farm houses, barns and corncribs, making trips through the orchard and nurseries, gliding silently across the meadows or encircling the stacks of grain in search of mice and insects. Thousands upon thousands of mice of different kinds thus fall victims to their industry. Their economic relations, therefore, are of the greatest importance, particularly on account of the abundance of the species in many of the farming districts, and whoever destroys them through ignorance or prejudice should be severely condemned" (Fisher, Hawks and Owls, 166-173).

Genus BUBO Duméril.

167. (375). *Bubo virginianus* (Gmel.). Great Horned Owl.

The Great Horned Owl is a tolerably common resident in all parts of the state wherever moderate-sized patches of timber remain. The amount of territory required to support a pair of rapacious birds, and the constant persecution to which they are subjected, prevent the species from ever becoming abundant.

The Great Horned Owl is generally considered as injurious, being the only one of our Owls which preys on poultry and birds to any extent. It feeds upon rabbits largely, and where the rabbits are so numerous as to be injurious to trees and shrubbery,

the Owl may render valuable service in their destruction. The Skunk is also frequently eaten, and the nest and plumage of the Great Horned Owl in the springtime very frequently evidence this by their odor. Where chickens are allowed to roost out of doors in wooded regions, it cannot be disputed that the Great Horned Owl considers them legitimate prey, and makes periodical visits to the hen-roost.

The Great Horned Owl nests the earliest of any of our Iowa birds. The eggs are usually laid during the last half of February, but I found a nest containing three slightly incubated eggs on February 6, 1904, near Coralville (Johnson county). Ellison Orr records the finding of a set February 1, 1896, in an old squirrel's nest in the fork of an elm tree near Postville (Fayette county), also two eggs from an old Hawk's nest February 8, 1896. I have found ten nests containing eggs in Hancock county, all being open nests, usually old nests of the Red-tail or Swainson Hawk, in large trees, 35 to 50 feet from the ground. On March 3, 1894, found two nests, one with two slightly incubated eggs, one with two fresh eggs; on April 6 the second nest contained two more slightly incubated eggs; March 8, 1895, one with three fresh, one with two considerably incubated eggs, snow and ice on the edge of both nests; April 3, three eggs in nest from which eggs were taken twice in 1894. February 22, 1896, three eggs, slightly incubated; February 29, two eggs advanced in incubation, one egg more so than the other; March 14, 1896, two fresh eggs; March 22, two more eggs in nest found February 29, which I left; on May 2 it contained one young bird covered with whitish down, and with the eyes not yet opened. The nest contained the hindquarters of a large rat and a pocket gopher. The Great Horned Owl lays a second set of eggs when the first set is taken, usually in the same nest, or in the immediate vicinity. Both parents forage extensively when the young are in the nest and keep them well supplied with food. Mr. W. G. Savage records one nest near Hillsboro, Van Buren county, which contained thirty-eight field mice and one Quail (Osprey, i, 10, 1897, 136).

The note of the Great Horned Owl is a deep-toned *whoo-whoo*, often repeated, all on the same pitch, and is seldom heard except in late winter and early spring. The presence of an Owl in the

woods is generally indicated by the flocking and cawing of all the Crows in the neighborhood. The Crows will follow an Owl from place to place for hours, but their noisy demonstrations appear to cause the Owl but slight annoyance.

168. (375a). *Bubo virginianus pallescens* Stone. Western Horned Owl.

There has been much confusion in the names of this paler-colored variety of the Great Horned Owl, it having been variously described as *B. v. subarcticus* (Hoy), *B. v. arcticus* Swains., *B. v. occidentalis* Stone, *B. v. pallescens* Stone, and *Asio magellanicus occidentalis* (Stone) Oberholser.

Witmer Stone, in a "Revision of the N. A. Horned Owls, With Description of a New Subspecies," (Auk, xiii, 1896, 153–156), proposes the name *occidentalis* in place of *subarcticus* Hoy, the latter being a synonym of *arcticus* Swains., selecting a type specimen from Mitchell county, Iowa (No. 26435, Coll. Acad. Nat. Sci. Phila., Mitchell county, Iowa, winter, 1880, coll. by W. L. Abbott), "probably a female; measures: wing 16; culmen 1.80; tarsus (to insertion of hind toe) 2.50; middle claw to sheath 1.25." Later, (Am. Nat., 1897, 236–7), he says: "This specimen, however, unfortunately, proves to be intermediate between *B. virginianus* and *arcticus*, and does not belong to the race which I had intended to rename, the latter not extending so far east (see Auk, Jan., 1897, 132)." He proposes for the Horned Owl of the interior United States (*subarcticus* of authors) the name *pallescens*. "*B. v. pallescens* is smaller and paler than the true *virginianus* (the wing measuring 15.75 in.), with much less rufous admixture. The barring on the belly is much finer and the feet almost pure white."

Harry C. Oberholser describes the species as *Asio magellanicus occidentalis* (Stone), ("Revision of the Horned Owls of the Genus *Bubo*," Proc. U. S. Natl. Mus., xxvii, 1904, 191), giving the range of *pallescens* as confined to the southwest. The geographical range of *occidentalis* is given as "western U. S. from Minnesota and Kansas to Nevada, southeastern Oregon, Utah and Montana, south in winter to Iowa;" type locality, Mitchell county, Iowa; also specimen from Grinnell. The Arctic Horned Owl, *A. m. wapacuthu*, ranges from northern Canada south in winter to northern U. S. from Idaho to Wisconsin. He says: "The breeding bird of Iowa is undoubtedly *virginianus*, though *occidentalis* occurs in winter."

County records: Hancock—I have three specimens taken in Hancock county, in typical pale plumage, one in April, 1891, and one January 26, 1894; shot a fine male on the edge of a grove near Lake Edwards, November 14, 1898 (Anderson). Johnson—Mus. No. 3347, female, January, 1887; rather pale, facial disc brownish, feet dusky; ochraceous tint not very pronounced but visible on nearly all parts. No. 3341, female, January 18, 1889; back whitish, slightly mottled and penciled with dusky; very little pale buffy on surface, seen only on parting feathers; feet and tarsi pure white; under parts white with sparse transverse marks and black spots on each side of breast; facial disc whitish; a rather small bird—length, 13.25; wing, 14; tail, 9.50; the general whitish appearance of this bird is very close to that of the typical Arctic Horned Owl, and is much lighter in color than many specimens of the Snowy Owl. Linn —"resident" (Bailey); "have found two nests of a very light-colored variety of the Horned Owl—am not sure as to whether this is 'Western' or 'Arctic'" (Berry). Monona—A University museum specimen taken at Little Sioux Dec. 8, 1884, is rather pale, intermediate in type (Anderson). Woodbury—Mus. No. 11612, Sioux City, February, 1889, shot by Chas. Hagelin, typical pale bird; No. 11610, female, Sioux City, 1889, D. H. Talbot, has feet nearly white; dusky bars below about half as wide as white bars, no dark patch on breast.

The extreme variability in plumage of the Western varieties of the Horned Owl makes an accurate determination of the subspecies very difficult. The typical ochraceous-tinted *virginianus* is by far the most common variety found in Iowa at all seasons, while the western form *pallescens* is quite often met with in winter and perhaps nests occasionally, as the April record from Hancock county (*supra*) would seem to indicate. The typical northern variety *arcticus* probably occurs rarely in winter, or at least, an intermediate between *virginianus* and *arcticus* (Witmer Stone, *supra*).

Genus NYCTEA Stephens.

169. (376). *Nyctea nyctea* (Linn.). Snowy Owl.

The Snowy Owl is a rather rare winter visitant in Iowa and somewhat irregular in its occurrence. Some winters numbers are

seen and other seasons none are reported. It is a diurnal species and is usually found on the prairies. The appearance of the bird varies greatly, according to the number of dusky bars on the white plumage. A specimen in the University museum, taken at Aurelia, Iowa, January 18, 1885, is pure white, and one which I mounted February 18, 1895, taken at Buffalo Center, Iowa, was pure white, with only four or five dark spots on the tip of each wing and two or three on the head. A female taken December 10, 1896, at Buffalo Center, was very dark, having sides, wings, and tail barred heavily with dark brown.

The Snowy Owl rarely appears in Iowa before December and usually leaves in March. W. H. Bingaman reports one taken in Kossuth county, April 18, 1900. Cooke (Bird Migr. in Miss. Val., 1884–85, 123) says: "It seems to have been less common than usual in the winter of 1883–4, though Mr. Lindley, Mitchell, Iowa, had the good fortune to see nine." D. H. Talbot notes the occurrence of many Snowy Owls at Sioux City during February, 1883 (Bull. Nuttall Orn. Club., viii, 4, 240).

The Museum of Natural History of the University of Iowa has skins taken at Plover, January 24, 1887; Hospers, March, 1887; Jolley, 1885; Sheldon, January 25, 1887; Little Sioux (no date); Sioux City, two, March 14, 1887; March 15, 1887; April 16, 1887 (very dark plumage); Bradgate, December 17, 1884; Hawarden, January 3, 1886; Sloan, December 17, 1886; Alta, two specimens (no date); Merrill, January 22, 1887; Forest City, March 19, 1901; Johnson county, March 17, 1890.

Genus SURNIA Duméril.

170. (377). *Surnia ulula caparoch* (Müll.). American Hawk Owl.

The American Hawk Owl can only be considered as an exceedingly rare straggler in Iowa, in the winter time. It has been reported rarely in southern Minnesota by Roberts (Geol. and Nat. Hist. Surv. of Minn., 1880, 471), and in Southern Wisconsin by Kumlien and Hollister (Bds. of Wis., 1903, 72).

George H. Berry reports the Hawk Owl as a rare winter visitant in Linn county. He states that he has taken one specimen in Iowa and also observed one specimen in December, 1903, near Cedar Rapids, but did not secure it.

Genus SPEOTYTO Gloger.

171. (378). *Speotyto cunicularia hypogæa* Bonap. Burrowing Owl.

The Burrowing Owl is essentially a bird of the Great Plains region of the United States, where it is common locally, nesting in the deserted burrows of prairie dogs, badgers, and gophers. Thomas L. Roberts observed the species July 19, 1881, in Swift county, western Minnesota, and states that many weeks spent in traveling through the prairie portions of that state failed to discover the presence of this bird in any other locality. Though the Burrowing Owl occurs sparingly at various points in northwestern Iowa, I have been unable to discover any published records of the fact.

County records: Dickinson—In the early fall of 1895, seven miles southwest of Lake Park, I believe that I saw a Burrowing Owl, or an owl having general characteristics of one rose from a collection of ground-hog or badger holes, but was not procured. I can say that it was not a Short-eared Owl. The bird rose within six feet of me. After watching it until out of gunshot it dawned upon me that it was an owl new to me, and from its size, color, action, location, etc., I made out that it was a Burrowing Owl" (Salisbury).

Kossuth—"One taken in Kossuth county, Iowa, two miles south of Minnesota line, two and one-half miles southwest of Elmore, Minn. It was shot either June 8th or 9th, 1904, in a pasture, and only one bird was seen" (Bingaman). This is the most eastern record I have seen, with the exception of stragglers (probably from captivity) in New York City and in Massachusetts.

Lyon—Prof. Bohumil Shimek states that the species is fairly common on the prairies of Lyon county, in the north-central and southwestern portions of the county, two or three being usually seen in a day's drive. He first observed them in 1896, and at other times later, while investigating the flora of the northwest corner of the state.

Sioux—"Summer resident, common; nests. The season of 1902 I found them in Sioux county, and at that time the young birds were out of the hole in which they lived, but could hardly fly at all, so I knew they were hatched there. This brood was at the

mouth of a badger hole. It is quite a common occurrence to find them 'towards evening standing at the mouth of the badger holes'' (Johnson). ''The Burrowing Owl in 1890 was fairly common on the prairie around Hawarden and, I think, occupied the old holes of the gray prairie squirrel. I shot three males and one female. Thirty-four miles west of Hawarden, at Beresford and Centerville, Lincoln county, S. D., they are abundant, and one can see a dozen of them in a mile walk across the prairie in the early twilight. On my way home from Dakota in August I caught a young male in a burrow, which I kept in captivity for over a year, when he escaped'' (Berry).

Woodbury—''Uncommon summer resident; breeds. I have seen this bird more than once in Iowa—three or more on one occasion. A farmer friend of mine told me about a pair or more that bred on his farm in this county. H. L. Bond, on Feb. 5, 1898, writes: 'A small colony of Burrowing Owls near town here (Meriden, Iowa) which affords me considerable amusement and instruction. I took a full set of eggs from one of their burrows' '' (Rich). ''Hearsay record but fairly authentic. An old Winnebago Indian that used to live upon the Winnebago Indian Reservation told me a short time ago that the ''little ground owls'' used to live in a prairie-dog town in the northwest corner of Woodbury county, Iowa. He saw them there about twenty years ago and the last time about fifteen years ago. He used to hunt in this region of Iowa often and is sure that the birds are as above mentioned'' (Trostler).

Order PSITTACI. Parrots, Macaws, Paroquets, etc.

FAMILY PSITTACIDÆ. Parrots and Paroquets.

The only species of this large family that ever occurred in the wild state in Iowa is the Carolina Paroquet, which is now practically extinct except in a few localities along the Gulf coast and in Florida.

Subfamily CONURINÆ. Wedge-tailed American Parrots.

Genus CONURUS Kuhl.

172. (382). *Conurus carolinensis* (Linn.). Carolina Paroquet.

The beautiful Carolina Paroquet formerly ranged in flocks as

far as the northern part of the state, but has not been observed in the state for at least thirty years and has practically been exterminated throughout the United States. Frank M. Chapman gives four reasons for its disappearance: "First, it was destructive to fruit orchards, and for this reason was killed by agriculturists; second, it has been trapped and bagged in enormous numbers by professional bird-catchers; third, it has been killed in myriads for its plumage; and fourth, it has been wantonly slaughtered by so-called sportsmen" (Birds East. N. A., p. 222).

Thomas Say states that the "Carolina perroquet" was seen several times during the winter of 1819-20 at Engineers' Cantonment (Long's Exp., 1, pp. 265-270). Prince Maximilian on May 14, 1834 (a little below "Wheeping-water River"), records: "Auch Papageien wurden gesehen, deren Gardner schon oben an l'eau qui court [Niobrara River] bemerkt hatte," etc. (Reise 11, 345). Audubon noted the species several times along the Missouri (Journals 1, 476); (May 8, 1843), "we saw Parrakeets and many small birds but nothing new or very rare" (southwest corner of Iowa), (Ibid, 477, Bellevue, Sarpy county, Neb., May 9, 1843); (Ibid, 481, near Council Bluffs, May 10, 1843), "Parrakeets and Wild Turkeys plentiful;" they were also heard by Bell between Ft. George and the Great Bend of the Missouri September 15, 1843 (Ibid, 11, p. 165). As late as 1863, F. V. Hayden noted the Paroquet as "very abundant in the Mississippi Valley along the thickly wooded bottoms as far up the Missouri as Fort Leavenworth, possibly as high as the mouth of the Platte, but never seen above that point" (Trans. Am. Philos. Soc., xii, 1863, p. 154).

The last Iowa record is that given by Dr. Coues in his "Birds of the Northwest," (1874 p. 296). "In Iowa, according to Mr. Trippe, the Parrot still occurs. 'A resident of Decatur county told me that he had several times seen a flock of Parrots in the southern part of the county on a tall, dead cottonwood tree, known to the neighboring inhabitants as the "parrot tree," from its having been frequented at intervals by the same flock for several years . . . . and that he had shot one of them on one occasion' (Pr. Bost. Soc., xv, 1872, p. 233)."

Paul Bartsch, in an article on "Birds Extinct in Iowa and

Those Becoming So" (Iowa Orn., 11, 1895, pp. 2-3), states that the Paroquet formally ranged as far north as Spirit Lake, where it would frequently remain until the cold snow would drive it southward. Its food in winter consisted chiefly of the seeds of the cocklebur. Its nature was so peculiar that when one of the number was killed or wounded, the others would gather around it with shrill cries and in this way the entire flock could easily be annihilated.

Dr. Rich states that many years ago the Paroquets were noticed just across the river from Sioux City, in Nebraska. Some were captured and kept as cage pets. A series of about a dozen specimens in the University museum were taken by D. H. Talbot's collectors at the mouth of the Arkansas River in 1882.

Order COCCYGES. Cuckoos, Kingfishers, etc.

Suborder CUCULI.

Family CUCULIDÆ. Cuckoos, Anis, etc.

Two species of Cuckoos represent this family in Iowa. They are slender brownish-gray birds with somewhat lustrous plumage. The voice is a rather hoarse croak. The American Cuckoos very seldom lay their eggs in the nests of other birds, but cases are known in which they have done so, and quite commonly the two species deposit eggs in each others' nests.

Subfamily COCCYZINÆ. Cuckoos.

Genus COCCYZUS Vieillot.

173. (387). *Coccyzus americanus* (Linn.). Yellow-billed Cuckoo.

The Yellow-billed Cuckoo is a common summer resident in all parts of the state, arriving in May and remaining until October. Its harsh notes have caused it to be sometimes known as "Rain-crow." The nests are usually placed in small trees or bushes, not over eight or ten feet from the ground and rather flimsily constructed. The eggs are laid in June, July and August, and half-fledged young birds are often found in the same nest with partially incubated, or even fresh eggs. Occasionally an egg of the Yellow-billed Cuckoo is found in a Black-billed Cuckoo's nest, or *vice versa*, but the Cuckoos are not habitually parasitic.

The Cuckoos are mostly insectivorous in diet, and a favorite food seems to be the "tent caterpillars," which so commonly infest shade and fruit trees.

174. (388). *Coccyzus erythrophthalmus* (Wils.). Black-billed Cuckoo.

The Black-billed Cuckoo is also a summer resident in Iowa. In some localities it appears to be less common than the Yellow-billed, while in other localities it is more abundant. Their habits are almost identical. The Black-billed Cuckoo seems to nest a little earlier in the season—from May to August. On May 25, 1891, I found a nest containing one egg, and the next day found it to contain four fresh eggs. The bird was on the nest on both occasions. June 27, 1892, found one nest containing three eggs; June 27, 1893, one nest containing a young bird nearly able to fly, the other contained one young bird, one egg that appeared to be nearly fresh, and another egg somewhat larger and paler (apparently a Yellow-billed Cuckoo's). July 2, 1893, found a nest containing one egg, about two feet from the ground, in a wild willow near a creek; July 7, this nest contained five eggs. All were observed around Forest City, Winnebago county. Both species of the Cuckoos are frequently heard in shade trees in cities, but are not very easy to observe, as they keep in the higher branches.

Suborder ALCYONES. Kingfishers.

Family ALCEDINIDÆ. Kingfishers.

The single species of Kingfisher which is found in Iowa, is very familiar along the banks of streams and ponds, where its favorite perch is on some limb overhanging the water, from which it plunges into the water after small fishes, crawfish, etc. Its note is a harsh rattle which is often repeated.

Genus CERYLE Boie.

Subgenus STREPTOCERYLE Bonaparte.

175. (390). *Ceryle alcyon* (Linn.). Belted Kingfisher.

The Belted Kingfisher is a common summer resident along the streams in all parts of the state, arriving early in March and remaining until the rivers and creeks freeze over—usually in November. It was observed once in Winneshiek county, January

8, 1897, by Mr. Hall Thomas. The nest is placed in a burrow dug in the perpendicular face of a cut bank, usually along a stream, but I have found them in railroad cuts and sandpits. The hole is generally six to eight feet in length and enlarged at the further extremity, where the five to eight pure white eggs are deposited upon a pile of fish bones and scales and crawfish shells. Mr. W. F. Loucks states: "Along the Cedar River, in Iowa, I found these birds in great numbers. A large clay bank along the river resembled a honeycomb, so numerous were the holes made by this bird. This is the only case that I know of where Kingfishers have been found breeding in close proximity" (Bendire, Life Histories of N. A. Birds, ii, p. 25). The eggs are deposited from the middle to the latter part of May. Both the male and female birds incubate, and the bird will frequently remain on the nest until removed with the hands.

Order PICI. Woodpeckers, Wrynecks, etc.

Family PICIDÆ. Woodpeckers.

The Woodpeckers are particularly adapted for climbing or creeping upon the bark of trees. The stout bill is used to chip away wood and bark and expose the hiding place of grubs and other larvæ, which are impaled upon the long, distensible, sharp-tipped tongue. They thus destroy large quantities of injurious insects which could be reached in no other way. All the Woodpeckers are thus distinctly beneficial. The eggs are uniformly white and are placed in a hole in a tree, generally in a dead limb hollowed out by the bird.

Genus DRYOBATES Boie.

176. (393). *Dryobates villosus* (Linn.). Hairy Woodpeckers.

The Hairy Woodpecker is a common resident in all parts of the state, but is most frequently observed in winter, when it often appears in towns. Speaking of the rolling tattoo of some Woodpeckers, Mr. Brewster says: "*P. pubescens* has a long, unbroken roll, *P. villosus*, a shorter and louder one with a greater interval between each stroke, while *S. varius*, commencing with a short roll, ends very emphatically with five or six distinct disconnected taps" (Ann. Lyc. Nat. His., xi, 1875, p. 144). Keyes and Williams state that the eggs are laid about the last of April.

177. (393a). *Dryobates villosus leucomelas* (Bodd.). Northern Hairy Woodpecker.

The Northern Hairy Woodpecker is a variety inhabiting the northern tier of the United States, through British America to the Pacific in Alaska. It is distinguished by its larger average size and hairy appearance. "Large specimens of the Hairy Woodpecker taken at Omaha in winter have been referred to this form by Skow and Trostler, but probably represent the maximum of *villosus*" (Rev. Bds. Neb., 1903, p. 59). A series of eight specimens from the Talbot collection, taken at Sioux City in November, 1885, and December, 1884, were sent to Robert Ridgway for identification. He says: "All these specimens are intermediate between *villosus* and *leucomelas*."

No. 13500. Dec. 12, L. 9; W. 5; T. 3⅜; "*leucomelas*."
No. 13499. Nov. 13, 1885, L. 9; W. 5; T. 3½; "*leucomelas*."
No. 13498. Dec. 6, L. 9; W. 4¾; T. 3¾; "not typical *leucomelas*."

The examination of a large series of winter Hairy Woodpeckers from northern Iowa will be necessary to determine the status of this subspecies in the state.

178. (394). *Dryobates pubescens medianus* (Swains.). Northern Downy Woodpecker.

The Downy Woodpecker is an almost exact counterpart of the Hairy Woodpecker, differing only in its smaller size. Their habits are similar, but the Downy Woodpecker is perhaps the more familiar, often appearing in towns, even condescending to peck at dead weed-stalks for food. The nest is frequently dug in a dead limb in an orchard. Charles R. Keyes reports that the eggs are laid early in May (Linn), and Dr. C. C. Smith, about May 20 (Winneshiek).

The species is of great value as a destroyer of the various wood-boring insects. In general, the Downy Woodpecker is a more abundant resident than the Hairy Woodpecker.

Genus PICOIDES Lacépède.

179. (400). *Picoides arcticus* (Swains.). Arctic Three-toed Woodpecker.

The Arctic Three-toed Woodpecker may only be expected as a casual winter visitant in Iowa, if it occurs at all at the present

time. Walter G. Savage writes: "About twenty years ago my father shot one, the only record I have in our locality. I have a painting of the bird and was with the man when he shot it. It was taken in the western part of Henry county, on Big Cedar."

W. W. Cooke states: "This is one of the migratory woodpeckers, but its movements are not extensive. In the Mississippi Valley these movements are limited to a migration from its summer home in British America to the United States, where it remains during the winter, returning in the spring. . . . Individuals have been known to occur in northern Illinois, but are seldom seen south of latitude 40°" (Bird Migr. in Miss. Val., 1884-85, p. 129).

It has been taken three times in the state, twice at Omaha, once by I. S. Trostler, December 15, 1895, and again by F. J. Breese, and at Dakota City by Wallace Bruner (Rev. Bds. Neb., p. 59).

Genus SPHYRAPICUS Baird.

180. (402). *Sphyrapicus varius* (Linn.). Yellow-bellied Sapsucker.

The Yellow-bellied Sapsucker is a common migrant over the whole of Iowa, and a tolerably common summer resident in most parts of the state, especially in the northern parts. The species usually arrives in the early part of April. "In the winter of 1884 it was found as far north as Danville, Illinois, and Morning Sun, Iowa, but was rare at both places. . . . Though rarely breeding south of latitude 42°, it nests regularly but a short distance farther north. It has been known to breed at La Porte City, Iowa (42°, 18′)," (Cooke, Bird Migr. in Miss. Val., 1884-85 p. 129). Walter J. Savage reports: "Common summer resident; I have two sets of eggs taken in Van Buren county." "Rather common; breeds; migratory," (Decatur and Mahaska counties, Trippe, Proc. Bost. Soc., xv, 1872, p. 233). J. E. Law took a set of eggs at Lake Mills in spring of 1893 (Winnebago). It is recorded as a summer resident from Poweshiek (Kelsey); Pottawattamie–Mills (Trostler); Polk (Johnson, Keyes and Williams); Blackhawk (Peck, Salisbury); Lee (Praeger, Currier); Linn (Keyes, Bailey, Berry); Warren (Jeffrey).

Genus CEOPHLŒUS Cabanis.

181. (405a). *Ceophlœus pileatus abieticola* Bangs. Northern Pileated Woodpecker.

The Northern Pileated Woodpecker was formerly a not uncommon resident in heavily timbered portions of Iowa, and an individual or isolated pair is still occasionally reported from localities where belts of native timber yet remain. Thomas Say noted it at Engineers' Cantonment February 28, 1820 (Long's Exp., i, 265–269), and Audubon, near the mouth of the Big Sioux, October 1, 1843 (Journals, ii, p. 170). F. V. Hayden says: "We often met with it along the wooded bottoms of the Missouri, especially in the state of Missouri, and in Kansas and Iowa" (Trans. Am. Phil. Soc., xii, 1863, p. 155–56).

County records: Blackhawk—"rare migrant" (Peck). Boone —"have only collected one specimen. About ten years ago a pair stayed in the heavy timber along the Des Moines River" (Henning). Decatur—"seen once or twice in spring" (Trippe, Proc. Bost. Soc., xv, 1872, p. 233). Henry—"three specimens noted in heavy timber near Big Cedar Creek, Sept. 15, 1894" (D.L.Savage). Kossuth—"two birds six miles south of Algona, now, 1905" (Bingaman). Lee—"resident; now scarce" (Praeger); "resident; very rare" (Currier); (Parker, Am. Nat., v, 1871, p. 169). Linn—"rare resident" (Berry); "pair near Cedar Rapids during summer of 1894" (Bailey). Polk—"rare summer resident" (Johnson). Van Buren—"resident; tolerably common" (W.G.Savage). Winneshiek—"shot one bird Feb. 29, 1896, the only record of its occurrence" (Smith). Woodbury—"Probably accidental. One was shot along Big Sioux River and mounted about ten or twelve years ago" (Rich).

Genus MELANERPES Swainson.

182. (406). *Melanerpes erythrocephalus* (Linn.). Red-headed Woodpecker.

The Red-headed Woodpecker is a common summer resident in Iowa and a few individuals occasionally remain through the winter, but not regularly. Their occurrence in winter seems to be dependent upon food supply rather than temperature, for I observed a single specimen all winter at Forest City during the

severe season of 1898-99 when the thermometer went for many days to 30° below zero. The bulk of the birds arrive about the first of May and leave the last of September. The Red-headed Woodpeckers do not confine themselves to woodland, but range out to the prairie farms, sometimes boring their nesting holes in telegraph poles. While mainly insectivorous, many of the birds are guilty of puncturing apples in orchards and eating other fruit at times. On the whole, however, they should be considered very beneficial.

In an article "On Changes of Habit Among Woodpeckers" (Am. Nat., xi, 1877, p. 471), Dr. Samuel Calvin says: "Within the past two or three years I have frequently had the pleasure of observing the red-headed woodpecker in the act of catching flies on the wing." He notes perching birds that have taken to tree climbing (*Mniotilta varia*, *Certhia*, *Sitta*) and considers that competition with climbing perchers may constitute a large share of the disturbing cause which has compelled certain woodpeckers of late to abandon the habits of their ancestors.

Chas. Aldrich noted one in the summer of 1877, on prairie half a mile from timber, eating grasshoppers (Bull., Nutt. Orn. Club, iii, 4, 1878, p. 189); and Major Bendire notes several instances of the species killing and eating other birds.

While the above variations in diet are exceptional, it is a fact that the Red-headed Woodpecker shows an adaptability to its surroundings which enables the species to hold its own under almost any conditions.

Genus CENTURUS Swainson.

183. (409). *Centurus carolinus* (Linn.). Red-bellied Woodpecker.

The Red-bellied Woodpecker is a tolerably common resident in the southern and central parts of the state, being reported by nearly all observers, but appears to be of very rare occurrence in northern Iowa. Dr. C. C. Smith says: "I shot a bird of this species March 28, 1897; very rare here" (Winneshiek); and Dr. B. H. Bailey shot a female in juvenile plumage at Lansing, August 12, 1904 (Allamakee). F. H. Shoemaker says: "A single bird was seen near Hampton on March 1, 1896, this being the only record of its occurrence" (Franklin). I never observed the species in Winnebago or Hancock counties.

Dr. T. S. Roberts (Auk., xvi, 1899, p. 236-246) reports the occurrence of the Red-bellied Woodpecker in Minnesota for the first time in the heavy timber of the Mississippi bottom lands in Houston county, a station many miles north of the usually assigned northernmost limit of its range in the Mississippi Valley. "They undoubtedly occur here regularly, and not so very infrequently, over a small area extending northward not to exceed twenty or thirty miles from the Iowa line, 43° 30′ N. latitude.

In Iowa the species is more or less migratory. The fact that it appears to be more abundant during the winter in some sections in the northern parts of its range has led some observers to believe that the species wanders northward in winter (Cooke, Bird Migr. in Miss. Val., 1884-85, p. 132; Coues, Birds of N. W., p. 289). Nesting records are rare in Iowa, but Morton E. Peck states that it breeds rather infrequently in Blackhawk county, and is a frequent winter resident.

Genus COLAPTES Swainson.

184. (412). *Colaptes auratus luteus* Bangs. Northern Flicker.

The northern variety of the Yellow-shafted Flicker, the "Yellow-hammer" or Golden-winged Woodpecker, is the commonest Woodpecker in Iowa, being an abundant summer resident in all parts of the state. It arrives early in March and usually departs in September. Occasionally individuals are observed in winter. In Winnebago county, I have seen specimens in November, December and February, but very rarely during these months. The nest is usually in a hole in a tree but sometimes other locations are chosen. Dr. G. C. Rich describes a nest near Sioux City with eggs in a hole in the bank of a "washout" (West. Orn., v, 3, 1900, p. 60), and W. A. Bryan saw a Flicker excavate a nest in the perpendicular-cut side of a haystack; hole twenty inches deep, eight feet from ground, dug directly into the stack for six inches, then turning directly downward; seven eggs taken May 28, 1890, and a second set June 14. When the eggs are taken the birds will frequently keep on laying eggs in the same nest. I have known as many as thirty eggs to be taken from a single pair of birds in this manner, and Keyes and Williams state that more than fifty have been taken.

185. (413). *Colaptes cafer collaris* (Vigors). Red-shafted Flicker.

The Red-shafted Flicker is the species found from the Plains to the Pacific, overlapping the range of the preceding species and intermingling and intergrading with it in many instances. The intermediate specimens have been sometimes classed as a separate species, *Colaptes hybridus* Baird, etc. It occurs rather frequently near the western border of Iowa, and individuals occasionally straggle to other portions of the state.

County records: Blackhawk—"A pair reported from Blackhawk county by Mr. Field of the State Normal. I think they were taken last fall—1903" (Peck). Boone—Two were seen and one shot near Boone by Cal Brown, Dec. 29, 1895 (Henning, Iowa Orn., ii, 3, p. 75). Cass—"only record, one in my collection killed near Atlantic, Sept. 25, 1896" (Pellett). Hardin—"In September, 1897, I found the remains of a specimen that had been killed" (Peck). Pottawattamie–Mills—"common summer resident" (Trostler). Sioux—"tolerably common near Hawarden; shot two" (Berry). Tama—"a pair observed in Tama county about twenty years ago by Mrs. E. M. Poyneer. The record is perfectly reliable" (Peck). Van Buren—"This flicker was shot about fifteen years ago and after a lot of overhauling was pronounced a hybrid" (W. J. Savage). Woodbury—"uncommon summer resident. One shot Sept. 23, 1894; another Oct. 25, 1900; also a record of one male Oct. 19, 1900. Others have been seen and shot" (Rich). "While the bird is not common in this part of the state, yet it is very frequently found. I have observed it here nearly every season for twenty odd years and have secured quite a number of specimens, including several hybrids, as I suppose them to be the offspring representing the crosses between the Red-shafted and Yellow-shafted Flicker" (D. H. Talbot, Sioux City, Iowa Orn., i, 3, 1895, p. 74). Winnebago—I have one specimen in my collection which was shot at Forest City in winter of 1890 or 1891 (Anderson).

Order MACROCHIRES. Goatsuckers, Hummingbirds, etc.

Suborder CAPRIMULGI. Goatsuckers.

Family CAPRIMULGIDÆ. Goatsuckers.

The Goatsucker family, so named from a traditional superstition, comprises the Whipporwills and Nighthawks. They are

mainly nocturnal, strictly insectivorous, and capture their prey in their capacious mouths while on the wing. During the day they generally pass the time crouching on the ground or perched lengthwise upon the branches of trees.

Genus ANTROSTOMUS Gould.

186. (417). *Antrostomus vociferus* (Wils.). Whipporwill.

The Whipporwill is a common summer resident in all wooded portions of the state, arriving in the latter part of April and departing in September. The species is almost strictly nocturnal, lying close in thick woodland during the day, and thus is very seldom seen. At night it is very active, hawking for night-flying insects with almost noiseless flight, and frequently alighting to utter its familiar *whip-poor-will* notes, which are well known to many people who have never seen the bird. When heard from a distance the notes give an attractive addition to a summer evening, but at close range are almost startling in their vehemence. The two eggs are deposited on dead leaves in the woods from the latter part of May until the middle of June, no nest being made. There is good evidence to the fact that both eggs and young are often removed in the parent bird's mouth if the nesting place is disturbed. However, I flushed a Whipporwill from her two eggs on three different days without causing her to change the location. The nest was found on a high bank of the Iowa River above Iowa City during the latter part of June, 1906.

Genus CHORDEILES Swainson.

187. (420). *Chordeiles virginianus* (Gmel.). Nighthawk.

The Nighthawk is an abundant summer resident in all parts of the state, arriving early in May and remaining until the first of October. It is more a bird of the open than the Whipporwill, and may be recognized by a conspicuous white spot on the primaries. It is sometimes seen perched lengthwise upon the limb of a tree in woodland, but more frequently roosts upon the ground in open situations. The two eggs are generally placed upon a bare spot on a hill top, but in cities the species frequently deposits its eggs upon the flat, gravel-topped roofs of large buildings, usually in early June. While the Nighthawk is generally more active in the early dawn of the morning and from late afternoon

until after dark, it often flies in the middle of the day, particularly in cloudy weather. Frequently the Nighthawk performs curious evolutions in the air, swooping rapidly downward with a rush, producing a dull, booming sound as the flight is checked. This habit has given it the name of "Bull-bat" in some localities. In September large scattered flocks are often seen leisurely flying southward for days in succession.

188. (420a). *Chordeiles virginianus henryi* (Cass.). Western Nighthawk.

This is a lighter colored variety of the Nighthawk in which the gray and fulvous tints exceed the darker colors. It is a bird of the western plains, but specimens have been recorded from western Minnesota, Illinois and Wisconsin. Kumlien and Hollister state: "Three specimens in Kumlien collection (pronounced typical by Dr. Coues). Two specimens secured later by Thure Kumlien in September, 1880" (Bds. of Wis., 1903, p. 79).

County records: Dickinson—"a large flock of the western variety was observed within a short distance of the state line, north of Lake Park, of which one specimen was shot and proved to be the gray western variety; about Aug. 20, 1895" (Salisbury). Hardin—a male in the Coe College collection, killed July 3, 1902, by Dr. B. H. Bailey, near Owasa, on the Iowa River, is very light colored on the wings, approaching very closely to *C. v. henryi*. Johnson—"Johnson county, Iowa, specimens in University museum" (C. C. Nutting, Proc. Iowa Acad. Sci., i, 1892, p. 41).

189. (420c). *Chordeiles virginianus sennetti* (Coues). Sennett Nighthawk.

The Sennett Nighthawk is an extremely pale variety inhabiting the unwooded country from Texas to Dakota. A silvery grayish-white coloration predominates above, the white below greatly in excess of the narrow, irregular or broken dark bars, and there is little or no rufous anywhere.

The first published record for Iowa is by Dr. Paul Bartsch (Auk., xvi, 1899, p. 86): "The Smithsonian Institution recently received a specimen of Sennett's Nighthawk from Mr. C. F. Henning of Boone, Iowa, taken four miles southwest of that place. This variety seems so far to have escaped Iowa observers and it gives me pleasure to add it to our list."

Two specimens in the D. H. Talbot collection, University museum, were sent to Robert Ridgway and identified as *sennetti*. No. 19833, male, Sioux City, Iowa, July 21, 1884; No. 17887, juvenile, Monona county, Iowa, Sept. 11, 1885. Dr. I. S. Trostler writes that the species is an "abundant migrant, common summer resident. This is the common variety (Pottawattamie–Mills). *C. v. henryi* also probably occurs. I have killed no *henryi* in Iowa, but have done so in Nebraska near the Missouri River."

Suborder CYPSELI. Swifts.

Family MICROPODIDÆ. Swifts.

The common Chimney Swift is the only representative of this family in Iowa. They are commonly but erroneously called Chimney "Swallows," chiefly from the similarity in their feeding habits with the true Swallows. They are strictly insectivorous, feeding entirely while flying, and a Swift is almost never seen to alight.

Subfamily CHÆTURINÆ. Spine-tail Swifts.

Genus CHÆTURA Stephens.

190. (423). *Chætura pelagica* (Linn.). Chimney Swift.

The Chimney Swift is an abundant summer resident in Iowa from the middle of April to the middle of September. They may be seen dashing overhead and twittering at all hours of the day, flying lower in cloudy weather. At the present time the nests are built almost exclusively in chimneys, composed of short dead twigs snapped off by the bird while on the wing and cemented together and to the chimney wall by the vascid saliva of the birds. In 1867 J. A. Allen (Notes on the Birds Observed in western Iowa, Mem. Bost. Soc., i, 1868, p. 498), reported the bird as "Common. Breeds in hollow trees. In no instance could I hear of its resorting to chimneys, which in general are poorly adapted to its needs, consisting either of a joint of stovepipe, or a patent one of cast-iron." The species has now almost forgotten its tree-nesting habits in Iowa, although Dr. Charles P. Keyes writes: "In June, 1894, I collected at intervals of two weeks, two nests and sets of four and five eggs of this species from a large hollow linden" (Linn county).

In the fall the Swifts congregate in flocks of hundreds at their favorite roosting place, usually some tall deserted chimney, for the night, soaring overhead and dashing in one by one. "The flocks drift slowly south, joining with other bands, until on the northern coast of the Gulf of Mexico they become an innumerable host. Then they disappear. Did they drop into the water and hibernate in the mud, as was believed of old, their obliteration could not be more complete. In the last week in March a joyous twittering far overhead announces their return to the Gulf coast, but the intervening five months is still the Swift's secret" (W. W. Cooke, "Some New Facts About the Migration of Birds." Yearbook Dept. Agri., 1903, p. 386).

Suborder TROCHILI. Hummingbirds.

Family TROCHILIDÆ. Hummingbirds.

The Hummingbirds compose a family of five hundred species, all confined to the new world. Seventeen species are found in the United States, and only one species reaches Iowa. They feed largely on insects, which they generally capture in flowers, and they also feed on the juices of flowers. Two white eggs constitute the nest complement.

Genus TROCHILUS Linnæus.

191. (428). *Trochilus colubris* (Linn.). Ruby-throated Hummingbird.

The Ruby-throated Hummingbird is a common summer resident in all parts of the state from the second week in May to the last of September. John Krider noted the species as very abundant in Iowa, "owing to the vast quantities of wild flowers which grow upon the prairies" (Forty Years' Notes, 1879, p. 20). At the present time the species is very commonly found in flowerbeds in dooryards, although the nest seems to be generally built in timber—a delicate affair resembling a lichen-covered knot. H. Heaton of Glendale says: "Last June when the black locust trees were in bloom in my dooryard, not fewer than forty hummingbirds at a time could be counted flitting among the blossoms" (West. Orn., v, 3, 1900, p. 60).

Order PASSERES. Perching Birds.

This order includes about six thousand known species, or more than half of all the kinds of birds. The toes are always four, the

hind toe on the level of the rest, and the feet are fitted for perching. The musical apparatus is more or less developed. The young are hatched weak and naked and must be fed in the nest by the parents for some time. Dr. Coues says: "They represent the highest grade of physiological development, as well as the most perfect physical organization of the class of birds. Their nervous irritability is great, coördinate with rapidity of respiration and circulation; they consume the most oxygen, and live the fastest, of all birds. They habitually reside above the earth, in the air that surrounds it, among the plants that with them adorn it; not on the ground, nor on the waters under the earth."

Suborder CLAMATORES. Songless Passeres.

Family TYRANNIDÆ. Tyrant Flycatchers.

The family is peculiar to America and most abundant in the tropics. As a rule they are sedentary and solitary, sitting motionless upon a limb or post, awaiting passing insects, upon which they pounce, returning to the same post after each capture. They are not voiceless, but have comparatively limited vocal powers.

Genus TYRANNUS Cuvier.

192. (444). *Tyrannus tyrannus* (Linn.). Kingbird.

The Kingbird is an abundant summer resident in Iowa from the last of April or first of May until the early part of September. The nesting season is from the first of June to the middle of July. B. H. Wilson reports the earliest nesting date as May 21, 1877 (Scott). The site varies widely,—in dooryards, in groves near dwellings, on farm machinery in yards and in the fields, in rows of trees along roads, and in thickets along streams. The most common situation is a tree along the roadside, about 15–20 feet from the ground, and the birds usually make noisy demonstrations when an intruder is in the vicinity. The Kingbird does not hesitate to attack a Crow or large Hawk, and never fails to put the enemy ignominiously to flight, flying above it and dashing down at its head. It is said to eat honey-bees at times, and is sometimes known as the "Bee-bird." Dr. Coues says it "destroys a thousand noxious insects for every bee it eats."

I once found a nest on the top of a slightly branched willow fence post in the middle of a slough, and another in a small iso-

lated scrub oak in a pasture. The eggs are usually four in number and exhibit two phases of coloration, some sets being spotted with clear bright brown, and others with dull purplish brown. I have found a runt egg normally marked, but smaller than a Wren's egg, in a Kingbird's nest.

193. (447). *Tyrannus verticalis* Say. Arkansas Kingbird.

The Arkansas Kingbird is the Kingbird of the Plains and the Pacific Coast, resembling the common Kingbird in size and habits, but having the black replaced by olivaceous and the white by yellow. It has been observed in Iowa somewhat rarely, principally in the western part of the state.

Dr. J. A. Allen states: "At Boonesboro a pair of large Flycatchers were seen in the timber, which I scarcely doubt were of this species. Having no gun with me at the time, I was unable to get them and did not meet with the species elsewhere." (Mem. Bost. Soc., i, 1868).

"Has until the last two years always been considered as a rarity in eastern Nebraska, where it occurs as a migrant. During the past month of May, 1905, it has been reported frequently, and in some localities as common, one Omaha observer having seen twelve in one day. There would seem to be considerable foundation for a belief that the species is extending its line of migration eastward" (Myron H. Swenk, Auk, xxii, 3, 1905, p. 320).

County records: Dickinson—"one nest found at Spirit Lake, June 15, 1902" (Bingaman). "Shot one July 30, 1902, at Spirit Lake; two others seen" (Bailey). Sioux—"tolerably common summer resident at Hawarden in 1895" (Berry); killed one, a male bird, the first one I ever found here, Hull, Iowa" (A. I. J., O. & O., xvii, 9, 1892, p. 133). Woodbury—"uncommon summer resident. Several were seen and two shot in September, 1903; also August 10 and 16, 1901; May 4, 1902; at Sioux City" (Rich).

Genus MYIARCHUS Cabanis.

194. (452). *Myiarchus crinitus* (Linn.). Crested Flycatcher.

The Crested Flycatcher is a rather rare summer resident in nearly all portions of the state, but was reported as only a spring and fall migrant in a few localities. In the southern and southeastern sections it is a tolerably common summer resident, being

reported as "abundant" (Currier) and "common" (Praeger) in Lee county; "common" in Van Buren (Savage) and Scott (Wilson). The eggs are generally laid in a hole in a tree, a deserted Woodpecker's hole. B. H. Wilson reports that in 1887 a pair nested in a birdhouse in an oak tree in the heart of the city of Davenport. Its habit of always using a bit of cast-off snake skin in the construction of its nest is famous and traditional.

Genus SAYORNIS Bonaparte.

195. (456). *Sayornis phœbe* (Lath.). Phœbe.

The familiar Phœbe, Phœbe-bird, or Pewee, is an abundant summer resident in all parts of Iowa. Its monotonous note of *pewit-phœbe* is heard very early in the spring, as the birds frequently arrive by the first of March and nest early in April. The nest is usually affixed to the vertical side or on top of a cross beam under a bridge, and few little country bridges can not boast of a Phœbe's nest. Sometimes the nest is placed in the crevice of a cliff, usually near a stream or in sheds and deserted buildings. The eggs are three to five in number, normally white, but occasionally sparsely dotted with brown. In 1893, one pair, I think, built four different nests, and eggs were taken from four different spots under the same bridge, as follows: June 3, four eggs, advanced in incubation; June 13, four fresh eggs; July 3, four eggs, slightly incubated; July 22, four eggs; all were unspotted. Its attachment to particular spots is very strong, and the birds return to nest in the same place year after year.

196. (457). *Sayornis saya* (Bonap.). Say Phœbe.

The Say Phœbe is a western species, of accidental occurrence east of the Mississippi. It has been found in northern Illinois, Wisconsin, Iowa, and more recently on Cape Cod, Massachusetts (Miller, Auk, vii, 1890, p. 228). In Nebraska it is "practically confined to the to the semi-arid portions of the state. Very common summer resident east to Chadron. Migrant in Holt county and once at Lincoln. Extending slowly eastward" (Rev. Bds. Neb, 1904, p. 67).

Dr. I. S. Trostler records the species as a rare summer resident in Mills county, and G. H. Berry states that he shot one female at Hawarden, Sioux county, in 1890.

Genus NUTTALLORNIS Ridgway.

197. (459). *Nuttallornis borealis* (Swains.). Olive-sided Flycatcher.

The Olive-sided Flycatcher is generally reported as a rather rare spring and fall migrant throughout the state during the latter part of May and the last week of August and first half of September. In a few localities it appears to be more common—Blackhawk (Peck); Kossuth (Bingaman); Dallas (Law, Iowa Orn., i, 2, 1895, p. 20); Winnebago (Anderson). On August 28, 1897, shot one male; September 4, saw one; September 5, saw two; September 12, 1901, saw several, at Forest City. They were generally perched upon the topmost branches of large dead trees and appeared rather heavy and slow in their movements.

Genus CONTOPUS Cabanis.

Subgenus CONTUPUS Cabanis.

198. (461). *Contopus virens* (Linn.). Wood Pewee.

The Wood Pewee is a common summer resident in woodlands in all parts of the state from the middle of May until September. Its drawling, plaintive note of *pee-a-wee* may be heard at all hours of the day throughout the season. The Wood Pewee nests rather late, saddling a very neat, lichen-covered nest upon a horizontal limb, usually at some distance from the ground, and often difficult to distinguish from a knot on the limb. B. H. Wilson gives the earliest nesting date in Scott county as June 15, 1889. I found two nests containing three eggs each on June 19, 1894, in Winnebago county, where the average date for complete sets is about June 25.

Genus EMPIDONAX Cabanis.

199. (463). *Empidonax flaviventris* Baird. Yellow-bellied Flycatcher.

The Yellow-bellied Flycatcher is a rather rare migrant and a casual summer resident in Iowa.

County records: Blackhawk—"regular and common migrant and rare breeder in Blackhawk county" (Peck). Boone—"not common" (Henning). Lee—"migrant, not common" (Currier, Praeger). Linn—"rare migrant" (Berry). Polk—"arrived at

Des Moines May 9, 1884" (Cooke, Bird Migr. in Miss. Val., p. 153). Poweshiek—"tolerably common transient" (Kelsey); "summer, not rare, Poweshiek and Jasper, tolerably common from May 15 to June 1" (L. Jones); (Parker, Am. Nat., v, 1871, 169). Scott—"rare migrant, May 24, 1890; June 2, 1889; Sept. 6, 1890; Sept. 16, 1889" (Wilson). Van Buren—"one record, shot in 1895" (Savage). Winnebago—"one specimen taken in September, 1890" (Law). Winneshiek—"rare summer resident. Reported by Hall Thomas" (Smith).

200. (465). *Empidonax virescens* (Vieill.). Green-crested Flycatcher.

The Flycatchers of the *Empidonax* group are rather difficult to distinguish from each other, as their plumage, general habits, and notes are quite similar. A peculiar choice of nesting sites is generally characteristic of each species, but this varies considerably. The Green-crested or "Acadian" Flycatcher is more eastern in its range, and is not reported by very many observers in Iowa.

Ernest Irons describes the species as nesting around Council Bluffs rather commonly from June 1st to 28th, frequenting dark, shady woods and deep ravines. All nests were in bushes or small trees on the side, near the bottom, of a ravine, preferably in ironwood saplings, though two were in hickories. Eggs are two to four, with markings distinct in outline and not blotched, as is sometimes the case with the eggs of *trailli* ("The Acadian Flycatcher in Pottawattamie County," Iowa Orn., ii, 4, 1896, pp. 80–81).

Charles R. Keyes reports the species as a "common summer resident in the heavier woods along Cedar River in Linn county. Several occupied nests can be found in a few hours' search during last week of May and first two or three weeks in June. Nests are swung to lower, outer branches of hard maples, ironwoods, pig-hickory, and whiteoaks." In Winnebago county it is rare. June 16, 1896, I took a nest with two eggs, found June 14, in a small bush, three feet from the ground, near a winding woodland road; birds very shy; one shot.

The Green-crested Flycatcher was also reported as a common summer resident in Blackhawk (Salisbury); "infrequent" (Peck); Lee (Praeger, Currier); Poweshiek (Kelsey, Jones); Warren (Jeff-

rey). B. H. Wilson reports it as "rare in Scott county; only one seen, shot May 21, 1888."

201. (466). *Empidonax trailli* (Aud.). Traill Flycatcher.

The Traill Flycatcher is reported as a tolerably common summer resident in nearly all parts of the state from the early part of May until September. Dr. Coues says (Key to N. A. Birds, 5th Ed., 1903, i, p. 529): "Replaces *alnorum* in western North America from the Plains to the Pacific; but specimens absolutely like *alnorum* are found in the West even to British Columbia, and others like *trailli* proper, east to Michigan, Illinois, Indiana, Ohio, etc., showing that in the Mississippi Valley at large no line can be drawn between the two forms. . . . May usually be recognized by its duller or more fuscous coloration, the quite lively olivaceous and yellowish shades of *alnorum* being subdued or overcast; wing bars duller and less conspicuous; bill larger; tarsi longer, the feet being nearly as in *virescens*." William Brewster (Auk, xii, 2, April, 1895) classes the Mississippi Valley birds south of latitude 42° as *trailli*, and northern and eastern birds as *alnorum*.

E. E. Irons records the species as nesting quite commonly in Pottawattamie county, in a valley or draw where the ground is damp and spongy, in a dense growth of small willows, where he took eggs at various dates from June 15 to July 14 (Iowa Orn., ii, 3, 1896, pp. 53–55). C. R. Ball reports it as a tolerably common summer resident in Lyon county, nesting beginning June 10th and lasting about three weeks. John V. Crone states that in 1889 he took three sets from the same hedge, and undoubtedly from the same birds. A fourth nest was found later with young—in Buena Vista county (Iowa Orn., i, 2, 1895, pp. 31–32).

In Winnebago county I have found the species rather common in restricted localities and absent from others. I examined about twenty-five occupied nests from 1894 to 1897, all of which were placed in dense thickets of small wild willows along the bank of a creek or a low piece of ground, at an average height of four feet from the ground. The eggs number three or four, usually four, and are deposited about the 25th of June. Accidents to the first set will cause second sets to be laid during the early part of July. The birds are very shy and are seldom surprised on the nest, the

only indication of the bird's presence being an occasional nervous *peep* in the dense surrounding thicket. The eggs are of a rich creamy color, sparsely speckled over the entire surface, or wreathed around the larger end with rich brown or burnt sienna color.

Robert Ridgway identified specimens taken in Winnebago county June 29, 1897, and Johnson county in May, 1892 (Mus. No. 14507), as *trailli*.

202. (466a). *Empidonax trailli alnorum* Brewster. Alder Flycatcher.

This is the common Traill Flycatcher of the eastern and northern states, "difficult if not impossible to distinguish from the western stock form . . . its western limits can not be given with precision, because this form shades into *trailli* proper in the Mississippi Valley" (Coues). Kumlien and Hollister state: "Mr. Brewster has kindly examined our small series of this group and pronounced the birds of late May and June typical *alnorum*, suggesting that it is no doubt the breeding form. He writes that it is interesting to find typical examples of the two forms in the same locality" (Birds of Wis., 1902, p. 83).

Prof. Charles R. Keyes writes from Mt. Vernon (Linn county): *E. t. alnorum*—from two to three pairs regularly nest in a thicket less than a half-acre in extent along Abbey Creek, one mile north of town. The four eggs are laid by June 22. Have never found them elsewhere but once, when a nest was found in hazel brush a half-mile further down the creek. The birds have occupied the little thicket mentioned for at least ten years."

203. (467). *Empidonax minimus* Baird. Least Flycatcher.

The Least Flycatcher is a common or abundant migrant in all parts of the state, but appears to be a summer resident and breeds commonly only north of the middle line of the state. Trippe, however, gives the species as "breeding in large numbers in Mahaska county, far less abundant in Decatur" (Proc. Bost. Soc., xv., 1872, p. 234). Dr. Trostler reports it as a "rare summer resident" (Pottawattamie); Peck, as an "infrequent breeder, mostly in open woods or about houses" (Blackhawk); Giddings, as a "tolerably common summer resident" (Jackson). The observers from southern Iowa unanimously report it as a migrant. In Winne-

bago the Least Flycatcher is an abundant summer resident, nesting almost anywhere, in trees along the roadside or in artificial groves near houses, sometimes in open woods, seldom more than fifteen feet from the ground. Four creamy-white unspotted eggs are laid about the middle of June, approximately a week before *trailli*. The birds are very tame and can frequently be caught by hand while on the nest.

Suborder OSCINES. Singing Birds.

Family ALAUDIDÆ. Larks.

The Horned Larks are the only representatives of their family found in America. There are about one hundred Old World species, of which the Skylark is the best known. They are almost strictly terrestrial and are sweet singers in the springtime.

Genus OTOCORIS Bonaparte.

294. (474). *Otocoris alpestris alpestris* (Linn.). Horned Lark.

The Horned Lark question has become so complicated of recent years by the differentiation of varieties that most of the records are confused. It is clear that the Prairie Horned Lark is the common resident and breeding variety in Iowa, while *O. a. alpestris* occurs in winter as a straggler from the northeast and *O. a. hoyti* from the northwest. The range of the large, dark-colored *alpestris* is given by Oberholser (Proc. U. S. N. M., xxiv, 1902, pp. 807–10) "in winter west to Manitoba and the Mississippi Valley, south regularly to Illinois, Ohio and the Carolinas, casually to Louisiana" [specimens from Hibbing, Minn., Mt. Carmel, Maywood, Cook County, Ill., etc.]. Kumlien and Hollister state that in Wisconsin it is "found on the prairies during winter, oftimes in considerable numbers. . . . It does not occur anywhere, under our observation, except on the larger prairies, while *praticola* is found in almost any field or pasture, even when quite small and surrounded by woods" (Bds. of Wis., 1903, p. 83). "A single specimen, taken at Lincoln, has been identified by Oberholser as typical *alpestris*. This record extends the known winter record of this species considerably westward" (Rev. Bds. Neb., 1904, p. 69).

The early Iowa records listed all the Horned Larks as *alpestris*, and it is questionable whether many of the later winter records

are not referable to *hoyti*. B. H. Wilson lists *alpestris* as a "tolerably common winter resident" in Scott county and M. P. Somes as "few" in Webster county.

205. (474a). *Otocoris alpestris praticola* Hensh. Prairie Horned Lark.

The Prairie Horned Lark is a common resident on prairies and fields throughout the state. The species is more or less migratory, and while a few birds may remain through the winter in the northern parts of the state, they are less numerous in the dead of winter. Large flocks usually appear in February. In Winnebago county the first set of eggs is generally completed by the first of April, although eggs are occasionally found in March. In southern and central Iowa the bird frequently breeds by the middle of March. These early nests are often covered by deep snows.

The early nests are almost invariably placed in pastures, on the ground upon a grassy knoll, while the second nest of the season is nearly always placed in a cornfield beside a hill of growing corn. Large numbers of nests are annually destroyed by the corn cultivator. C. R. Ball states that three broods are raised in a season, the finding of fresh eggs as late as July 15th being not uncommon in Lyon county (Iowa Orn., i, 2, 1895, 32–34). The female bird is a close sitter, and the nest may be almost stepped on before she will fly. The eggs number three to six.

In the springtime the Prairie Horned Larks are often seen perched on a fence post or a little rise of ground, uttering a low but pleasing song of a few notes. Occasionally in early spring the song is heard while the bird ascends high in the air by little short flights, then soars down to the ground with a long sweep. The birds show little fear of persons or animals, and in northern Iowa is the species which probably is most commonly included under the vague but comprehensive name of "ground-bird."

The Prairie Horned Lark is a species which has changed its range very much since the settlement of the United States. As the country has been cleared and the forests removed it has extended its range from the Mississippi Valley to New York and even to New England.

206. (474k). *Otocoris alpestris hoyti* Bishop. Hoyt Horned Lark.

This large pale variety ranges "in summer, British America

from the west shore of Hudson Bay to the valley of the Mackenzie, north to Arctic Coast, south to Lake Athabasca; in winter southwest to Nevada, Utah, Kansas and Michigan, casually to Ohio and New York (Long Island). . . . In winter *hoyti* ranges southward into the upper Mississippi Valley at least as far as Kansas, but keeps chiefly west of the river. [Specimens from Sargeant Bluffs, Iowa, Madison, Minn., Grand Rapids, Mich.]" (Oberholzer, "Review of the Larks of the Genus Otocoris." Proc. U. S. N. M., xxiv, 1902, pp. 812–815).

A typical specimen in the Talbot collection, Mus. No. 14124, was killed at Sergeant Bluffs, Iowa, January 1, 1886; L. 7.38; W. 4.40; T. 2.88; skinned by John E. Swanson. Two other specimens, one dated February 9, 1886, and one March 21, 1886, skinned by Swanson, but with no locality mark, are probably from the Sioux City neighborhood.

Prof. Lynds Jones of Oberlin, Ohio, writes: "I made a careful study of upwards of fifty specimens taken in winter at Grinnell before *hoyti* was elaborated, and then concluded that the large birds must be *alpestris* in spite of the fact that they were far too light. I am now convinced that they were *hoyti*. The Horned Lark question awaited the solution which the form *hoyti* demanded."

In Nebraska *hoyti* occurs as a "regular winter visitant, occurring over the entire state, appearing usually in February. . . . Omaha, West Point, Covington." *Otocoris alpestris leucolæma* (Pallid Horned Lark) is given as an abundant resident, breeding east to at least the 99th meridian, in winter over whole state, but uncommon eastward (Rev. Bds. Neb., 1904, p. 67). Oberholser also records a specimen of *leucolæma* from Omaha, Neb. (Proc. U. S. N. M., xxiv, 1902, pp. 812–15), so that it is probable that it occasionally occurs as a straggler in western Iowa in winter, although no Iowa specimens have been recorded.

Family CORVIDÆ. Crows, Jays, Magpies.

The *Corvidæ* inhabit wooded regions and are usually resident species, although they are migratory to a certain extent. They are omnivorous, eating fruits, grain, insects, eggs, or even carrion.

Subfamily GARRULINÆ. Jays and Pies.

Genus PICA Cuvier.

207. (475). *Pica pica hudsonica* (Sabine). American Magpie.

There have been no records of the occurrence of the Magpie in Iowa during recent years, and if any are taken they must be considered only as accidental stragglers from the northwest. In the early days the occurrence of the Magpie in the state was not uncommon. Thomas Say noted the bird at Engineers' Cantonment in winter, stating that it "retired northward March 23, 1820" (Long's Exp., 1819–20). In 1843 Audubon says that at Fort Croghan (near Omaha), "I saw two Magpies in a cage that had been caught in nooses by the legs" (Journals, i, pp. 480–1). F. V. Hayden states: "I have never observed them below Council Bluffs, and from thence to the mountains they increase in numbers" (Trans. Am. Philos. Soc., xii, 1863, p. 171); "known to have been taken in Lee county" (Parker, Am. Nat., v, 1871, p. 169). Dr. Elliott Coues states: "In ascending the Missouri I saw the first Magpie near Sioux City, Iowa, a point immediately on the border of its eastward dispersion" (Birds of the N. W., 1874, p. 212). John Krider reports: "I was fortunate enough to find one specimen of this bird in the spring of 1875 in Winnebago county, Iowa" (Forty Years' Notes, p. 54).

Morton E. Peck writes: "A specimen was taken in a steel trap in Blackhawk county by a trapper who was perfectly familiar with the bird in the West. This is an old record, perhaps thirty years old, but I am sure it is quite authentic."

"The only record I know of for Lee county is the mounted bird now in possession of Dr. R. Heiser of Keokuk. It was killed four miles west of the city by a Mr. Turner, a farmer. It was in the winter time and the bird came about the barnyard, but I cannot give the date. It was in the '70's, I think" (E. S. Currier). "A mounted specimen, destroyed before I saw it, was obtained in Lee county, close to Keokuk, about 1893. The bird is so peculiar I don't think there can be any mistake of the facts. I made careful inquiries" (W. E. Praeger).

"I have no record of birds taken in Iowa, but the Magpie years ago was not uncommon here (Sioux City), so I have been told. The specimen I have measured was shot in Nebraska just

a few miles from city limits across the Missouri River" (Dr. Guy C. Rich).

Genus CYANOCITTA Strickland.

208. (477). *Cyanocitta cristata* (Linn.). Blue Jay.

The Blue Jay is an abundant and familiar resident in all parts of the state. While common throughout the year, the species seems to perform an imperfect migration, as scattering flocks containing hundreds of individuals are often seen flying southward in September or October, and northward in the spring. The Blue Jay feeds principally upon acorns and hazelnuts in the fall, often haunts the vicinity of farmers' corncribs during the winter, and in summer has a fondness for berries and fruits. The most reprehensible habit of the Blue Jay is its penchant for destroying the nests of other birds, eating the eggs or nestlings.

The Blue Jay's eggs are generally laid in Iowa from the second to the last week in April, according to latitude, and second sets are to be found during the whole month of June. The nests are rather bulky, composed of sticks and lined with fine rootlets, placed either in deep woods or in evergreens or shade trees in dooryards. The disposition of the bird varies from that of a bold, saucy marauder, stealing the small boy's store of hazelnuts from a shed roof, perching on the corn-crib roof, picking up kernels in the pig-pen or crumbs from the dooryard, to the wild, wary fellow haunting the tree-tops in deep woods, his loud *chay chay* apprising all its denizens of the approach of an intruder. A flock of Blue Jays appear to take great delight in tormenting an owl, and will follow one for hours, making the woods ring with their screams.

Genus CORVUS Linnæus.

209. (486). *Corvus corax sinuatus* (Wagl.). American Raven.

The Raven probably does not occur in Iowa at the present time. If it does it can only be accounted as a very rare or accidental straggler. Formerly it ranged over the whole of the United States but now is restricted to wild and restricted localities. "The restriction of its range in the United States is probably reducible to a fortuitous matter, since this bird, like some others, sooner or later finds the advances of civilization unsupportable, and retires to regions more congenial to its wild and wary nature" (Coues, Birds of N. W., p. 205).

Thomas Say notes the raven at Engineers' Cantonment—"the young nearly able to fly May 12, 1820" (Long's Exp., i, pp. 265–269). Prince Maximilian noted the "Kolkrabe" above the Nishnabotna River May 1, 1833, and at the mouth of the Platte, May 3, 1833 (Reise, i, p. 290). Audubon writes May 11, 1843: "A fine large Raven passed at one hundred yards from us, but I did not shoot [below mouth of Little Sioux]" (Journals, i, p. 484).

T. M. Trippe states that "a resident of Decatur county who had become familiar with the Raven in the northwest assures me that he had occasionally seen it in this county" (Pr. Bost. Soc., xv, 1872, p. 240).

Mr. George H. Berry reports that a correspondent observed a specimen near Rockford, Iowa, in 1900, feeding with Crows. It was also observed to be much larger than the Crows, which makes the record appear probable.

Kumlien and Hollister report that while the Northern Raven (*C. c. principalis* Ridgw.) is common at several points along Lake Superior, it has been rarely seen in southern Wisconsin of late years. Nelson found it a rare winter visitant in northern Illinois in 1876 (Birds of Wis., pp. 85–86). Whether any of the Iowa records pertain to this northern and eastern variety can not now be determined.

210. (488). *Corvus brachyrhynchos* C. L. Brehm. American Crow.

The Common or American Crow is an abundant resident in all parts of the state. In spring and summertime the Crows are less gregarious than at other times, but in winter they usually congregate in large flocks, patrolling wide areas of country daily in search of food and at night returning to regular roosting places where hundreds or thousands may spend the nights. J. W. Preston records a roost near Baxter, Iowa, where during the winter of 1891-92 the number was estimated at forty thousand birds. He notes many birds dying of starvation, due to blindness from freezing of the cornea in severe weather (Bendire, Life Hist. N. A. Birds, ii, 409–410).

The Crow is omnivorous, and the question of its economic value or injuriousness has been much discussed. The Crow pulls up much corn in the springtime, but he destroys multitudes of cut-

worms; also mice, grasshoppers, crickets, grubs, etc.; he destroys many nests of small birds and robs the poultry yard of eggs and small chickens very frequently. He also acts as a scavenger, feeding commonly upon carrion. In the wintertime the vicinity of slaughter-houses is a favorite rendezvous for Crows. The Crows seem to have a natural antipathy toward the Hawks and Owls and large numbers will congregate to mob an unfortunate member of this family. Whether injurious or beneficial, the Crow seems well able to take care of himself, adjusting himself to every new condition, for in spite of continuous persecution for generations there seems to be no diminution in the numbers of this species in nearly all parts of the country and, indeed, an increase in most parts of Iowa since the settlement of the state.

Contrary to the general rule in the East, the Crows in Iowa commonly build their nests in rather small trees, second-growth oaks or poplars in small groves, usually not over thirty-five feet from the ground, sometimes not over fifteen feet. The usual number of eggs is five, but four, six or seven are sometimes found, from the latter part of March until the first of May. Occasionally a white or albino Crow is observed. W. A. Bryan reports having seen one with a white head near New Sharon, and mounted one taken in Story county in 1882, which was a dirty white color all over (Iowa Orn., i, 3, 1895, pp. 58–62). Although a wary bird, the Crow becomes remarkably tame when taken from the nest while young.

Genus NUCIFRAGA Linnæus.

211. (491). *Nucifraga columbiana* (Wilson). Clarke Nutcracker.

The Clarke Nutcracker is essentially a bird of the coniferous forests of the West, occasionally straggling eastward to Dakota, Nebraska and Kansas. "Dr. Agersborg took a specimen at Vermillion, S. D., in October, 1883 (Cooke, Bird Migr. in Miss. Val., p. 159), and a specimen was shot in the western outskirts of Milwaukee in the fall of 1875 (Kumlien and Hollister, Birds of Wis., p. 86). In Nebraska, "in fall and winter, spreading south and east to Sidney, Kearney, North Platte, and even to Omaha" (Rev. Birds Neb., p. 72).

The only Iowa record is a specimen in the museum of the University of Iowa, No. 10753, shot by Cal Brown four miles south

of Boone, Iowa, September 23, 1894, and donated to the museum by Carl Fritz Henning. (Recorded by Nutting, Proc. Iowa Acad. Sci., 1894, p. 44; and by Henning, Iowa Orn., i, 3, 1895, p. 63).

Family ICTERIDÆ. Blackbirds, Orioles, etc.

This is a distinctively American family, some species of which are with difficulty distinguished from the *Fringillidæ*. They inhabit plains and marshes as well as woodland, and feed on fruit, seeds and insects.

Subfamily AGELÆINÆ. Marsh Blackbirds.

Genus DOLICHONYX Swainson.

212. (494). *Dolichonyx oryzivorus* (Linn.). Bobolink.

The Bobolink is a common migrant in all parts of the state, and while it is found in summer in most favorable localities in the state, does not now appear to breed commonly except in the central and northern portions. It arrives in the state in the first part of May, the male coming some days in advance of the female. The male is a musical songster in spring and during the period of incubation, restlessly flitting over the meadows, balancing on swinging weed-stalks and fairly bubbling over with the ringing *bob-o-link* notes. The female is a dull-colored sparrow-like bird and is seldom seen. T. M. Trippe noted the species as breeding abundantly in Decatur county, southern Iowa, but rare in Mahaska (Proc. Bost. Soc., xv, 1872, p. 238). Prof. C. C. Nutting (Proc. Iowa Acad. Sci., 1892, p. 41) reported the species as increasing near Iowa City, but it appears to be rare here at the present time. B. H. Wilson gives it as a common summer resident in Scott county; earliest seen April 28, 1887, and set of five fresh eggs taken May 28, 1889.

In Winnebago and Hancock counties the Bobolink is an abundant summer resident, frequenting grassy meadows, where the nest is very carefully concealed in the center of a clump of grass, halfway between the short upland grasses and the long slough grass. The female bird has a habit of running through the grass for some distance before taking flight, making the nest difficult to locate. Eggs are laid about June 1st. After the young are hatched, males, females, and young assume the same dull yellowish plumage, and during the latter part of July and August frequent

rushes, weeds and wild rice along creeks and sloughs, departing for the south about the middle of September.

Genus MOLUTHRUS Swainson.

213. (495). · *Moluthrus ater* (Bodd.). Cowbird.

The Cowbird is an abundant summer resident in all parts of the state, arriving about the middle of April and remaining until the latter part of October. A few birds sometimes remain throughout the winter in southern Iowa. The Cowbird is the only Iowa bird which is habitually and notoriously parasitic, never building a nest of its own and depositing its eggs in the nests of other, usually smaller, birds. The eggs are generally laid before the owner of the nest has completed laying, and as the Cowbird's egg hatches in about ten days, sooner than those of most birds, the rightful owner's offspring are often crushed to death and crowded from the nest. Most birds do not seem to mind the imposition and I have seen a tiny Warbler busily feeding a young Cowbird twice as large as herself, after it has left the nest. I have found a number of nests of the Yellow Warbler in which a second story has been added to the nest after a Cowbird's egg has been laid, imbedding it in the bottom of the nest. This is not done if the Warbler has laid any of her own eggs. W. A. Bryan has also found a Traill Flycatcher's nest with a Cowbird's egg imbedded.

In "Observations on the Cowbird" (Iowa Orn., iii, 1897, pp. 4–7), David L. Savage reports the finding of eggs from April 22 to July 27, nests containing from one to five Cowbird's eggs. He notes twenty species which are imposed upon, viz.: Robin, Towhee, Vesper Sparrow, Chipping Sparrow, Field Sparrow, Blue-gray Gnatcatcher, Blue-winged Warbler, Yellow Warbler, Worm-eating Warbler, Baltimore Oriole, Orchard Oriole, Pewee, Kingbird, Red-eyed Vireo, Wood Thrush, Indigo Bird, Scarlet Tanager, Prairie Horned Lark, Yellow-breasted Chat, Water Thrush, Western Yellow-throat, Ovenbird, Meadow Lark, Rose-breasted Grosbeak, and Redstart. The Field Sparrow and the Indigo Bird were most imposed upon, and the Kingbird was the only species that objected. Other observers in Iowa have reported the Bluebird, Brown Thrasher, Warbling Vireo, Bobolink, and Barn Swallow, and I have noted in addition the Red-winged Blackbird, Least Flycatcher, Traill Flycatcher, Yellow-throated Vireo, and

Dickcissel. The species is polygamous and usually stays in small flocks during the summer, frequenting pastures, feeding about the feet of horses and cattle, and often alighting upon the animals' backs.

Genus XANTHOCEPHALUS Swainson.

214. (497). *Xanthocephalus xanthocephalus* (Bonap.). Yellow-headed Blackbird.

The Yellow-headed Blackbird occurs as a straggler in all portions of the state. It is only found as a common summer resident in the northern and western parts of the state, where in some places it breeds in colonies of hundreds or thousands in large prairie sloughs. The eggs are laid during the last week of May and first of June, usually three or four in number, but I have found two or three sets of five in several hundred nests examined in Winnebago and Hancock counties. The nests are rather bulky structures, composed of blades of dead slough grass and lined with thinner strips of grass-leaves, hung between last year's standing stalks of cat-tails or the tall, slender miniature canes of the common reed (*Phragmites*). In some localities—Big Lake, Pottawattamie county, etc., (Trostler)—the species was reported as building its nest in wild rice.

While the Yellow-headed Blackbirds feed upon seeds to a great extent, in the springtime large numbers of grubs are picked up on the plowed fields. The species shows a great fondness for certain localities, where they may abound, while other suitable marshes in the near vicinity may not show a single bird.

In some counties the species is very rare. C. C. Nutting records one specimen taken in Johnson county in 1892 by J. T. Paintin (Proc. Iowa Acad. Sci., 1892, p. 41); two specimens taken near Burlington (Bartsch); seen twice in Mahaska (W. A. Bryan, Iowa Orn., i, 2, 1895); a few seen in May, 1895, Winneshiek (Dr. C. C. Smith); "rare in Linn county; none seen in the last ten years" (Keyes); "rare visitant at Keokuk; breeding in Clark county, Mo." (Currier); "breeding commonly near Perry, Dallas county" (Law).

Genus AGELAIUS Vieillot.

215. (498). *Agelaius phœniceus* (Linn.). Red-winged Blackbird.

The Red-winged Blackbird is a common or abundant summer

resident in all parts of the state from the middle of March until the middle of November. The nest is generally placed in a bunch of grass, sedges or cat-tails in marshy situations, but sometimes in willows along the banks of streams. They nest usually in colonies, and the ringing note of *kong-quer-reé* may be heard throughout the summer. In the fall they congregate in immense flocks and sometimes do damage to grain-fields. W. W. Cooke estimated that 300,000 birds of this species were living on Muscatine Island in April, 1878. On April 6, 1883, Mr. W. A. Lester notes the same state of affairs, saying that they have been roosting by thousands in the timber on Muscatine Island for a month or more (O. & O., 1883, p. 51). Occasionally a few individuals are seen in winter, even in the northern part of the state. I have seen a single specimen near Forest City during the early part of January.

Carl Fritz Henning reports a perfect albino shot north of Boone September 17, 1893, (O., 30, xviii, 1893, p. 143). M. E. Halvorsen also shot one in Winnebago county about July 1, 1901, and saw another, an albino, at the same time. The Winnebago county specimen is in my collection. The eggs are usually laid from the 15th to the 30th of May, four or five in number, pale blue, variously streaked, spotted and blotched with black in fantastic patterns.

Charles Aldrich of Webster City, in 1881, noted a diminution in number during the preceding twenty-five years, due to the drainage and tillage (Am. Nat., xv, 1881, pp. 476–7). This diminution has probably occurred in all parts of the state as settlement proceeded, although the Blackbirds easily adapt themselves to circumstances, and hold their own fairly well.

216. (498). *Agelaius phœniceus fortis* Ridgw. Thick-billed Redwing.

"The Thick-billed or Northern Redwing is similar to *A. p. phœniceus* but decidedly larger and with the bill relatively much shorter and thicker; adult male and female in winter plumage, and immature male similar in coloration to the same of *A. p. sonoriensis*, differing from the latter in larger size and conspicuously shorter and thicker bill. Breeding range, Mackenzie R., Athabasca, and other interior districts of British America. During

migrations, the Great Plains, from eastern base of Rocky Mountains to Manitoba, Minnesota (Fort Snelling, May 11); Nebraska (Omaha, March 9); Iowa (Burlington, Oct.), etc.; western Illinois (Henderson county, Morgan county, March)." (Ridgway, Bds. of N. and Mid. Am. Part II.)

Four specimens from the Talbot collection at the University were submitted to Robert Ridgway who pronounced them *fortis*. No. 12467, Blue Lake, Iowa, October 22, 1884. W. 120^{mm}; T. 80^{mm}; B. (culmen) 21; B. (depth) 11.5^{mm}. 12466, Blue Lake, 1885, W. 128, T. 86; B. (culmen) 23; B. (depth) 12.5. 12468, Monona county, Iowa, October 14, 1884, W. 122; T. 82; B. 24; B. (depth) 13. 12459, Monona county, Iowa, October 14, 1884, W. 124; T. 93; B. (culmen) 24; B. (depth) 13.

The collection contains ten other specimens from Blue Lake and Monona county, 1884–85, which conform to the measurements given for *fortis*. The Thick-billed Redwing will without doubt prove to be a fairly common migrant in Iowa when series of specimens taken in migrations are examined critically.

Subfamily STURNELLINÆ. Meadow Starlings.

Genus STURNELLA Vieillot.

217. (501). *Sturnella magna* (Linn.). Meadow Lark.

The Meadow Lark is a summer resident in all parts of Iowa, being found in nearly all meadows and pastures in the eastern part of the state, arriving in the middle of March and remaining sometimes until the middle of October. In western Iowa the Western Meadow Lark is the more common form. C. R. Ball reports *magna* as breeding in Lyon county (Iowa Orn., i, 2, 1895, p. 40), and Dr. Trostler reports it as a scarce resident in Pottawattamie and Mills.

The eastern form *magna* is distinguished by having the black bars on wings and tail confluent along shaft of the feathers and yellow of chin usually confined between rami of lower mandible. The western form *neglecta* is duller and paler, with black on wings and tail usually resolved into distinct bars, and the yellow of chin usually encroaching on sides of lower jaw. The notes of the two species are strikingly different, the Eastern Lark having a clear, plaintive whistle, while the Western bird has a much louder tone,

with a rich, mellow, almost flute-like timbre. When once heard it can not be mistaken.

The Meadow Lark is a hardy bird, appearing with the earliest migrants, and a few occasionally remain during the winter in southern Iowa, Lee county (Praeger, Currier); Scott county (Wilson); and a few have been seen in midwinter in Buena Vista (John B. Crone, Iowa Orn., i, 2, 1895, p. 40). They begin to nest about the last of April and eggs have been found as late as July, so that it is probable that two broods may be reared. The nest is placed on the ground in meadows and pastures, very carefully concealed. While pairs are usually isolated during the summer, the Meadow Larks assemble in flocks in spring and fall.

An albino specimen in the University museum, No. 3684, male, was collected by J. T. Paintin at Coralville, Johnson county, July 30, 1889. The back is white with faint brownish tracings on secondaries and scapulars; throat and belly tinged with pale canary yellow, brighter along median line of breast, and fading anteriorly and posteriorly.

218. (501). *Sturnella magna neglecta* (Aud.). Western Meadow Lark.

The Western Meadow Lark is the commoner form of the species in the western half of the state, and specimens have been reported from a number of the eastern counties. There is considerable evidence to show that this form is slowly extending its range eastward. The two forms are found together in most parts of the state, but there appears to be very little intergration and specimens are readily differentiated.

Dr. J. A. Allen states: "In 1867 I found var. *neglecta* the prevailing form in central and western Iowa, from Boone county westward" (Bull. Nutt. Orn. Club, v, 1, 1880, p. 53). Prof. W. J. McGee (Ibid, p. 53) noted *neglecta* in Chickasaw county, May 25, 1879, one hundred miles farther east than any in which he had previously seen the species. During the next few days he saw perhaps a dozen individuals of *neglecta* in Floyd and Mitchell counties. He also says: "I saw several individuals (notably one near Rudd, Floyd County) which I was totally unable to identify as either *S. magna* or *S. neglecta*, either by markings, habits, *attitude* or *voice*. They seem to hold an intermediate posi-

tion in all characters between the best marked extremes." In the American Naturalist (xxii, 1888, p. 1122–24) a review of Prof. W. J. McGee's paper before the A. O. U. states: "The two species or geograpical varieties, whichever they may be, are distinguished by certain peculiarities in their song. The eastern species, *Sturnella magna*, extends about two-thirds way across the state of Iowa, while the western form, *S. neglecta*, is found nearly as far east as the Mississippi River. At the extremes of distribution both of the forms are easily recognized and are typical examples. But in the intervening region, where the two overlap, as it were, the birds were not to be positively separated by note alone, a sight of the bird being generally necessary for positive identification. Whether the variation in song was due to imitation of one by the other or to an actual intermingling of the two, he did not attempt to decide."

T. M. Trippe noted the occurrence of the two forms together in Decatur and Mahaska counties, *S. magna* predominating (Proc. Bost. Soc., xv, 1872, p. 239), saying: "The former (*neglecta*) is never heard after the first of September, although it arrives as soon, or a little before the other, viz., early in March, while the latter remains till November. I have never heard a bird whose notes were intermediate between the two."

A series of fifty-six skins in the Talbot collection, University museum, collected at Sioux City, Iowa, mostly in June, July and August, are all typical *neglecta*, showing no intergradation, averaging as pale as a series from Nebraska and Indian Territory, and paler than a specimen from Provo, Utah. One specimen, No. 18004, male, Sioux City, June 15, 1884, is darker than the others, with anterior bars confluent, but with yellow encroaching on cheeks; a very similarly marked specimen, No. 17786, was taken in Johnson county, April 12, 1890. No. 17786, taken at Elm Creek, Nebraska, November 6, 1884, has the bill curved in an arc like that of the California Thrasher, but the bill is more slender. Some county records of interest are given:

"One was killed at Iowa City this year. The species is gradually moving eastward; quite common in Fayette" (Paul Bartsch); a specimen taken in spring of 1892 by H. J. Giddings, in Jackson county (Iowa Orn., i, 2, 1895, p. 41). "In Blackhawk and Hardin counties this form seems to be gradually crowding out the

type of the species. Twenty years ago the western Lark was considered uncommon; at present they are largely in the majority" (M. E. Peck). "Do not know the proportion it bears to the preceding. They appeared last fall (1903) to be more common in migration than as breeders in Linn county" (Charles R. Keyes). "Rare about Decorah, but becoming more common. More common in western portion of Winneshiek county" (Dr. C. C. Smith). Found in Winnebago and Hancock counties in about the same numbers as *S. magna* (Anderson).

Subfamily ICTERINÆ. American Orioles.

Genus ICTERUS Brisson.

Subgenus PENDULINUS Vieillot.

219. (506). *Icterus spurius* (Linn.). Orchard Oriole.

The Orchard Oriole is a common summer resident in all parts of Iowa, arriving about the first of May and departing in September. B. H. Wilson reports the earliest date of arrival as April 26, in Scott county. The eggs are laid from the latter part of May until the middle of June; three to four in number. The nest is a very beautiful structure, not exactly pensile, but generally suspended between slender twigs of upright branches, composed of fine green grass blades, which cure like hay, retaining some greenness for a long time, and is lined with cottony substances. The nests are not generally placed so high as the Baltimore Oriole's, from ten to thirty feet from the ground, usually in artificial groves, Lombardy poplars or willows, near houses or in orchards. The song of the Orchard Oriole is loud, clear, and richly modulated.

Subgenus YPHANTES Vieillot.

220. (507). *Icterus galbula* (Linn.). Baltimore Oriole.

The beautiful Baltimore Oriole is an abundant summer resident in all parts of the state, arriving about the first of May and remaining until the middle of September. It is one of our most familiar birds, known by its clear, whistling notes and by the wonderfully woven nest, which is suspended like a pouch from the top of some swaying branch. The favorite nesting site appears to be elm trees and maples, in dooryards, and sometimes in poplars, willows, cottonwoods, etc. The bird is equally at home

around country farmhouses or in villages and towns, constructing its nest of strings, thread, hairs, bits of cloth, or anything fibrous that can be woven into a compact fabric. The eggs are four to six in number, dull white, commonly blotched, clouded and scrawled with black, brown and purplish markings. The eggs are generally laid by the first of June.

Subfamily QUISCALINÆ. American Grackles.

Genus EUPHAGUS Cassin.

221. (509). *Euphagus carolinus* (Müller). Rusty Blackbird.

The Rusty Blackbird is a common migrant in all parts of the state, appearing in small flocks, often in company with Red-winged Blackbirds, from the middle of March until the latter part of April and from the middle of September until the early part of December. B. H. Wilson reports a pair wintering at Rock Island Arsenal in 1899–1900, becoming very tame and coming to the guard-house every day for crumbs. Fall specimens are much more rusty-plumaged. They feed on the ground in fields or in open swampy woods on and along the borders of streams. Frequently, in spring, a flock will be seen densely massed in a tree, all singing at once, in a confusing medley. The uniform color of plumage and pale eyes distinguish the species from other Blackbirds at this season.

222. (510). *Euphagus cyanocephalus* (Wagl.). Brewer Blackbird.

The Brewer Blackbird is a western species, distinguished from *E. carolinus* by its violet-purple head and comparative absence of rusty tips to the feathers. It is a rather rare straggler in Iowa during the migrations, occasionally reaching even to Illinois and Wisconsin. It is recorded from the whole of Nebraska, "Omaha, etc.,—migratory, passing in October and latter part of March and April" (Rev. Bds. Neb., 1904, p. 75). Cooke (Bird Migr. in Miss. Val., 1884–85, pp. 173–74) records their appearance at La Porte City, Iowa, March 26, 1885. W. H. Bingaman writes that "the Brewer Blackbird is a rare migrant in Kossuth county; not unusual during the fall migration. I am well acquinted with the species and secured many sets in Canada." Ridgway, Coues, Bendire, and other authorities also give the species as occurring in Iowa.

Genus QUISCALUS Vieillot.

223. (511b). *Quiscalus quiscalus æneus* (Ridgway). Bronzed Grackle.

The Bronzed Grackle is an abundant summer resident in all parts of the state from the early part of March until November, and a few occasionally remaining during the winter. They nest in colonies in groves about farmhouses and sometimes in shade trees in cities, when they are often seen walking slowly upon the lawns, apparently not noticing passers-by. Sometimes several nests are placed in one tree. J. W. Preston describes a vast colony which nested in the tops of wild plum trees near Cairo Lake, Hamilton county, in 1881 (Bendire, Life Histories, ii, p. 503). About the first of August they begin to gather in flocks and in September and October enormous quantities are sometimes seen, frequently doing considerable damage to the corn crops.

Charles R. Keyes (The Auk, v, 1888, p. 207) describes immense flocks composed of about equal numbers of Red-winged Blackbirds, Rusty Blackbirds, and Bronzed Grackles, which congregated in the swamps and woodlands opposite Burlington, Iowa, during September and October, flocks of several thousands passing the day in the cornfields of Iowa, returning to the Illinois side at night. "These flocks are often a quarter of a mile in width and more than an hour in passing. . . . Making liberal deductions for any possibility of overestimating, the numerical minimum of individuals in a single flock cannot be far from twenty millions." Paul Bartsch, in 1895, states that "the species has decreased in numbers . . . seven or eight years ago, enormous flocks at Burlington" (Iowa Orn., i, 2, 1895, pp. 43–44).

Family FRINGILLIDÆ. Finches, Sparrows, etc.

This is the largest family of birds, both in number of species and of individuals. In North America about one-seventh of all the birds are *Fringillidæ*. Dr. Coues says: "Any one United States locality of average attractiveness to birds has a bird fauna of over two hundred species, and if it be away from the seacoast, and consequently uninhabited by marine birds, about one-fourth of the species are *Mnioltiltidæ* and *Fringillidæ* together, the latter somewhat in excess of the former." All are distinguished by a

conical bill, adapted for seed-crushing, and feed largely on seeds, but also eat berries and insects.

Genus HESPERIPHONA Bonaparte.

224. (514). *Hesperiphona vespertina* (W. Cooper). Evening Grosbeak.

The Evening Grosbeak is an erratic wanderer, and while large flocks may occur in any part of Iowa from September to April, or even May, its appearance is very irregular and the bird may be absent from the same locality for several years before appearing again. Charles R. Keyes (Auk, v, 1888, p. 114) notes their appearance in the vicinity of Iowa City in February, 1884, and in the winter of 1886–87 from December to April 30. From February 23 to April 30 a flock of about one hundred visited the University campus daily, feeding principally upon the *samaræ* or key-fruits of the box-elder trees, also the seeds of sugar-maples, and leaf buds. They were very tame. It was also reported from Charles City in March, Grinnell in December, April and May, and at Burlington. C. C. Nutting reports two secured in December near Iowa City by J. T. Paintin (Proc. Iowa Acad. Sci., 1892, p. 41).

Recent records: Dickinson—"observed it on or about Sept. 20, 1895, at Lake Park" (Salisbury). Johnson—saw one male on University campus Feb. 14, 1902 (Anderson). Winnebago —"killed two at Forest City in 1902" (Halvorsen). Winneshiek—"on March 7, 1896, Mr. Hall Thomas took two specimens, and on April 18, two more; very large flocks" (Smith). Linn— "I saw a flock of ten in Blairstown, Dec. 2, 1894. Two shot at Mt. Vernon in spring of 1895" (Keyes); "flocks remained in Cedar Rapids for some time during February, 1904; several specimens shot" (Bailey).

Genus PINICOLA Vieillot.

225. (515). *Pinicola enucleator canadensis* (Cab.). American Pine Grosbeak.

The Pine Grosbeak is an inhabitant of the northern coniferous forests, and consequently is not to be expected regularly in Iowa, although it occasionally appears as a straggler in winter.

County records: Floyd—"a few small flocks appeared in the

vicinity of Charles City in winter of 1878–79" (Keyes and Williams, Bds. of Iowa, p. 43). Hardin—"a rare autumn and spring visitor" (Peck). Jackson—"Dec. 1, 1903, two males were shot near the mouth of the Maquoketa River and sent to me—my only record" (Giddings). Linn—"rare winter visitant" (Berry). Mitchell—"three during winter 1883–84" (J. W. Lindley, O. & O., 1883, p. 33); (Cooke, Bird Migr. in Miss. Valley, 1884–85, pp. 178–79). Story—"one specimen taken at Ames Dec. 23, 1889" (Osborn, Cat. Coll. Ia. Agr. Coll., p. 8). Webster—"few; winter" (Somes).

Genus CARPODACUS Kaup.

226. (517). *Carpodacus purpureus* (Gmel.). Purple Finch.

The Purple Finch is a common migrant in the northern and central portion of the state, and a winter resident in the southern portions of the state. Praeger reports it as a "common winter resident" and Currier as an "abundant winter resident" in Lee; Trostler as an "irregular winter visitant" in Pottawattamie and Mills; Berry as a "common winter visitant" in Linn; William Savage as "rare in winter" in Van Buren (Iowa Orn., i, 1, 1894, pp. 1–2); W. G. Savage as a "common winter resident" in Van Buren; Giddings as an "occasional resident in winter" in Jackson. The Purple Finches usually appear in central Iowa in March and April and leave northern Iowa early in May; reappear in fall from September to December.

The only nesting record for Iowa is that of David L. Savage, who found a nest near Salem, Henry county, June 2, 1892, in an apple tree, eighteen feet from the ground. The Purple Finch is a sweet songster in the spring. In migrating flocks usually not more than one-fourth to one-eighth of the birds show the rosy or so-called purple plumage of the adult males, the remainder being dusky streaked females or young males.

Genus LOXIA Linnæus.

227. (521). *Loxia curvirostra minor* (Brehm.). American Crossbill.

The American Crossbill or Common Crossbill is a rather common winter visitant in Iowa but is somewhat erratic in its wanderings and may be entirely absent from a locality for a number

of years and then reappear in large flocks. Keyes and Williams state that "at Charles City, during the spring of 1878, it appeared in large numbers, remaining until the first week in May. In July of the same year a flock was also noted in Floyd county" (Birds of Iowa, p. 141). W. W. Cooke (Bird Migr. in Miss. Val. in 1884–85, p. 141) says that "not a single record was made during the winter of 1883–84 . . . The winter of 1884–85 was marked ornithologically, in the upper Mississippi Valley, by the great abundance of Crossbills of both species. In Iowa they stayed all winter at Coralville and were seen April 18 at Knoxville (fifty birds), and May 1 in Grinnell. The latest records are Coralville, May 21," etc.

While the mandibles of the Crossbill are so constructed as to be most useful in shelling the seeds from pine cones, the birds are not confined to evergreen groves in Iowa, but feed commonly on sunflower and hemp seeds and the seeds of various weeds. While the species has been recorded from nearly all portions of the state it occurs more regularly in the northern parts of Iowa and is rare in the southern counties. The majority of the records are in the months from October to February.

228. (552) *Loxia leucoptera* (Gmel.). White-winged Crossbill.

This species usually appears with flocks of American Crossbills, but is much rarer. Keyes and Williams state that it is usually only noticed in midwinter.

County records: Blackhawk—"one shot by myself early in fall, four or five years ago—only one ever observed here" (Salisbury). Hardin—"fall of 1900 at Iowa Falls" (Halvorsen). Johnson—"a flock summered near Iowa City in 1885" (J. T. Paintin), (Nutting, Proc. Iowa Acad. Sci., 1892, p. 41). Linn—"shot one in town in winter of 1893, the only one I ever saw here (Cedar Rapids). It was with about twenty Common Crossbills" (Berry). Pottawattamie-Mills—"irregular winter visitant" (Trostler). Poweshiek—"rare winter visitant" (Lynds Jones). Story—"rare at Ames" (Osborn, Cat. Col. Iowa Agri. Coll., 1891, p. 8). Van Buren—"ten years ago one was shot and brought to me for identification" (W. G. Savage); "one specimen with flock of American Crossbills in 1881" (Wm. Savage, Iowa Orn., i, 1, 1894, p. 2). Woodbury—"uncommon winter resident" (Rich).

Genus LEUCOSTICTE Swainson.

229. (524). *Leucosticte tephrocotis* Swainson. Gray-crowned Leucosticte.

"Breeding on higher mountains from Rocky Mts. of British America to Mt. Whitney, Calif.; migrating in winter through Rocky Mt. district of U. S. to Colorado; east, occasionally to western Iowa" (Ridgway). "Once recorded from Omaha by L. Skow, who knew it in the western part of the state" (Rev. Birds Neb., p. 84). The only definite Iowa record I have found is that of D. H. Talbot, at Sioux City, who states that in February, 1883, (an extremely cold month) several specimens were captured by boys in the western part of the city. A specimen kept alive had lost all rosy color after moulting—August 22 ("The Gray-crowned Finch in Confinement," Bull. Nutt. Orn. Club, viii, 4, 1883, pp. 240–42).

Genus ACANTHIS Bechstein.

230. (528). *Acanthis linaria* (Linn.). Redpoll.

The Common Redpoll or Redpoll Linnet is a somewhat irregular but abundant winter visitor. Some winters flocks of hundreds are seen, and during other seasons they will be rare. In southern Iowa the species is rarely seen, but in northern Iowa they appear nearly every winter, often visiting towns. Its principal food is the seed of ragweeds and various large weeds which project through the snow. Flocks alight upon these in large numbers, picking off the seeds which cling to the stalks as well as those which fall upon the snow. It frequently happens that only two or three rosy-pink males are found in a flock of two or three hundred specimens. The Redpolls are generally found from December until March, but Dr. C. C. Smith has noted them as early as Dec. 3 and as late as April 5 in Winneshiek county.

231. (528b). *Acanthis linaria rostrata* (Coues). Greater Redpoll.

"A northern species, rarely seen in the U. S. The only instance of its capture within the Mississippi Valley is the record of a specimen taken Nov. 2, 1878, at Chicago, Ill., by Mr. H. K. Coale" (Cooke, Bird Migr. in Miss. Val., 1884–85, p. 182).

"Mr. J. H. Brown, Iowa City, Iowa, writes: "I shot three Greater Redpolls on Jan. 11, and one the 13th inst. They were undoubtedly of the variety *Acanthis linaria rostrata* Coues. I

have never seen mention of this variety occurring in the state before" (Iowa Orn., ii, 2, 1896, p. 50).

Genus ASTRAGALINUS Cab.

232. (529). *Astragalinus tristis* (Linn.). American Goldfinch.

The American Goldfinch or "Yellow-bird," known by its bright yellow body and black cap, wings and tail, is a common resident throughout the year in all parts of Iowa, but is usually less common during the winter. The winter birds of both sexes assume a dusky, grayish-brown plumage with an olive tinge, and wander about in flocks, feeding upon weed seeds. The birds remain in flocks through most of the year, delaying the nesting period until late in the summer, usually until the thistles have ripened their down. The nests are built during July, August and September, in thistles, bushes or small trees, from four to twenty feet from the ground, composed of grass, fine rootlets, etc., and almost invariably lined with the soft white down of the thistle; eggs pale blue, unspotted. On September 5, 1897, I took a set of four eggs, advanced in incubation, from a nest six and one-half feet from the ground in a burr-oak (Winnebago). David L. Savage records a set of four eggs, September 16, 1893, from a nest placed in a thistle (Van Buren). (Oöl., x, 12, 1893. p. 326.)

In summer and fall the diet is varied, the favorite food being thistle seeds, sunflower, hemp and lettuce seeds. The song is frequently given as the bird wings its undulating up-and-down course through the air.

Genus SPINUS Koch.

233. (533). *Spinus pinus* (Wils.). Pine Siskin.

The Pine Siskin is a tolerably common but somewhat irregular visitant in Iowa, appearing in varying numbers from September until the spring migration. It is frequently found in company with the American Goldfinch, feeding upon lettuce, cabbage and beet seed-tops in gardens in the fall. Large quantities of the seeds of the ragweed are also consumed. The birds are very tame, allowing a person to approach within a few feet before flying, and returning again in a few minutes. During the season of 1896–97 the Siskins were unusually numerous in many localities. G. H. Berry reported large flocks around Cedar Rapids during February, 1904.

Genus PASSERINA Vieillot.

234. (534). *Passerina nivalis* (Linn.). Snowflake.

The Snowflake or Snow Bunting is only found in Iowa as a winter visitant, in large flocks, which remain almost exclusively on the fields and prairies. In the northern portions of the state the Snowflake is a tolerably common and regular winter resident, large flocks often appearing in November and are observed at irregular intervals until March. W. W. Cooke notes that "in the spring of 1885 the last were reported from Grinnell, April 25" (Bird Migr. in Miss. Val., p. 184). In southern Iowa they are rarely seen, appearing only during severe winter. Wm. Savage states that he has seen only two flocks in thirty years in Van Buren county (Iowa Orn., i, 1, 1894, p. 3).

Genus CALCARIUS Bechstein.

235. (536). *Calcarius lapponicus* (Linn.). Lapland Longspur.

The Lapland Longspur is a regular and abundant winter visitant in all prairie regions of the state. Flocks of thousands are often seen on the fields in early spring, restlessly running about, squatting close to the ground when approached, and frequently rising by hundreds as by a common impulse, circling about and alighting in another place. In northern Iowa the greater numbers are seen in October, November and early December, and again in February and March, often remaining until the middle of April. In southern and central Iowa they are more frequent in midwinter.

236. (537). *Calcarius pictus* (Swains.) Smith Longspur.

The Smith Longspur is a rather rare migrant or winter visitant in the state, straying from the northwest.

County records: Blackhawk — (Salisbury). Decatur — "the *Plectrophanes pictus* visited southern Iowa last fall in great numbers, appearing toward the close of October. In its habits it does very similar to the Lapland Longspur, but differed in being less gregarious and in showing a partiality for wet meadows and moist low-lying prairie swales, while the Longspur prefers the cornfields and higher grounds, as a rule, and does not appear until some weeks after *pictus*" (Trippe, Am. Nat., 1873, p. 500). Johnson—one specimen in Bond collection, University museum, from

Tiffin, Iowa (Anderson). Lee—"I have dates of April 11 and 20, but believe I have seen it at other times" (Praeger); "common migrant" (Currier). Linn—"rare winter visitant; shot one from a mixed flock in December, 1902" (Berry). Pottawattamie-Mills —"common winter visitant" (Trostler). Poweshiek—"tolerably common winter visitant" (Kelsey). Polk—"one specimen secured at Des Moines, April 18, 1885, is now in Iowa Agricultural museum, Ames" (W. A. Bryan); another specimen taken at Des Moines, on same date, by Prof. C. C. Nutting, is in the University museum, No. 1473 (Anderson). Scott—"not common migrant in spring, March 30 to April 16; no fall records" (Wilson).

237. (538). *Calcarius ornatus* (Towns.). Chestnut-collared Longspur.

The Chestnut-collared Longspur is a bird of the western plains, occurring in Iowa rather early as a migrant or winter visitant. The species is not known to breed in Iowa, although in 1896 J. H. Brown and J. Eugene Law found two nests in Jackson county, Minnesota, a short distance north of the Iowa line.

County records: Howard—"more common than any other species in winter. They are, I believe, the most common bird breeding in South Dakota. Do not breed here" (E. B. Webster, Cresco). Jefferson—"I identified this bird in Jefferson county, Iowa, in 1896" (W. G. Savage). Linn—"Cedar Rapids, Iowa, —Bailey" (Nutting, Proc. Iowa Acad. Sci., 1892, p. 40); "common winter visitant" (Berry). Poweshiek—"rare winter visitant" (Kelsey). Pottawattamie—"common migrant" (Trostler). Van Buren—"winter resident; very rare" (W. G. Savage). Winnebago—"shot at Forest City in 1903" (Halvorsen).

Genus RHYNCHOPHANES Baird.

238. (538). *Rynchophanes mccowni* (Lawr.). McCown Longspur.

"The McCown Longspur is a bird of the region of the upper Missouri and its tributaries, north to the Saskatchewan. . . . East probably to Iowa and Missouri" (Coues); "of casual occurrence in Illinois" (Chapman, Hd. Bk. Bds. E. N. A., p. 290). "An uncommon migrant . . . . Omaha," etc.(Rev. Bds. Neb., p. 85). Dr. I. S. Trostler reports it as a "common migrant in Pottawattamie county. I have identified specimens which I shot to be McCown's."

Genus POOCÆTES Baird.

239. (540). *Poocætes gramineus* (Gmel.). Vesper Sparrow.

The Vesper Sparrow, Bay-winged Bunting, or Grass Finch, is a common migrant in all parts of the state and breeds in most portions, but appears to be more common in summer in the central and northern parts of the state. Nests are built on the ground in pastures, meadows and cornfields. H. J. Giddings notes a nest in a potato patch (Jackson county). Carleton R. Ball reports that the species has increased rapidly in the last few years in Lyon county (Iowa Orn., i, 1, 1894, p. 4). The birds arrive from the south in the early part of April and remain until October. The Vesper Sparrow is a pleasing songster, usually uttering its song from a fence-post or other elevated spot in the early morning and late afternoon. The species is easily recognized by the chestnut bend of wing and white outer tail feathers. Specimens from Sioux City were identified by Robert Ridgway as belonging to the eastern variety, *P. g. confinis* not appearing in Iowa.

Genus PASSERCULUS Bonaparte.

240. (542a). *Passerculus sandwichensis savanna* (Wils.) Savanna Sparrow.

The Savanna Sparrow is a tolerably common migrant in all parts of the state and is a summer resident in a few localities. It arrives early in April and has been observed as late as October 26 (Scott county).

County records: Booone—"fairly common" (Henning). Decatur and Mahaska—"not very common; breeds. An inhabitant of the bushy margins of pools and watercourses on the prairies" (Trippe, Proc. Bost. Soc., xv, 1872, p. 237). Hancock—shot three specimens May 15, 1897 (Anderson). Jackson—"rare summer resident" (Giddings). Johnson—shot male, April 13, 1901 (Anderson). Lee—"scarce migrant" (Praeger); "common migrant" (Currier). Polk—"has been observed during the summer on the prairie sloughs of Polk county" (Keyes and Williams, Birds of Iowa, 1899, p. 142). Poweshiek—"tolerably common summer resident" (Kelsey). Van Buren—"common, nesting on the ground by a tuft of grass or large weed" (Wm. Savage, Iowa Orn., i, 1, 1894, p. 4). Webster "few" (Somes). Winneshiek—"have seen

it a few times" (Smith). Woodbury—"uncommon summer resident" (Rich).

Genus CENTRONYX Baird.

241. (545). *Centronyx bairdi* (Audubon). Baird Sparrow.

The Baird Sparrow is a common but locally distributed species of the western plains, sometimes occurring in Iowa during migration. W. W. Cooke states: "It was noted in migration at Grinnell, Iowa, April 25. At Grinnell it occurs in fall as well as spring" (Bird Migr. in Miss. Val., 1884–85, pp. 189–90). Carl Kelsey reported it as a "tolerably common transient visitant" and Lynds Jones as a "rare transient visitant" in Poweshiek county. Dr. I. S. Trostler gives the Baird Sparrow as a "common migrant in Pottawattamie county April 10 to May 10, never recorded in fall."

On June 14, 1899, I took a set of five slightly incubated eggs, with female parent, in Nelson county, North Dakota. The nest was placed in thick grass on high upland prairie.

Genus COTURNICULUS Bonaparte.

Subgenus COTURNICULUS Bonaparte.

242. (546). *Coturniculus savannarum passerinus* (Wils.) Grasshopper Sparrow.

The Grasshopper Sparrow is a tolerably common summer resident in most parts of the state from the latter part of April until October. Its favorite resorts are upland prairie and old weed-grown stubble-fields or "summer fallow" land. It has a peculiar insect-like note, like the stridulation of a grasshopper, and is often quite plentiful although rarely seen. Charles R. Keyes states that in Linn county they begin nesting in the middle of May and keep it up through July. The nests are well concealed in the grass and are often roofed over; eggs three to six.

243. (546a). *Coturniculus savannarum bimaculatus* (Swains.). Western Grasshopper Sparrow.

This pale-colored, grayer western variety of the Grasshopper Sparrow is found quite commonly in western and northwestern Iowa. The varieties are hard to distinguish except by comparison of both forms, and as their ranges overlap, it is questionable

how many of the Iowa records of *passerinus* refer to this subspecies. Robert Ridgway (Birds of N. and Mid. Am., i, p. 20) gives its range as extending "east to western Minnesota and Iowa, eastern Kansas, etc."

Two specimens from my collection, taken at Forest City, Winnebago county, one, a male, June 3, 1893, and one October 5, 1894, were identified by Ridgway as *perpallidus* [*bimaculatus*], while he identified a female from the Iowa University museum, taken at Sioux City August 12, as *passerinus*. On August 6, 1897, M. E. Halvorsen showed me a nest near Forest City containing one egg and three young birds, just hatched, in the short grass of a clover and timothy field that had been mowed a few weeks previously.

W. H. Bingaman reports the Western Grasshopper Sparrow as a "common breeder" in Kossuth, and Dr. I. S. Trostler as a "common summer resident" in Pottawattamie county.

Genus AMMODRAMUS Swainson.

244. (547). *Ammodramus henslowi* (Aud.). Henslow Sparrow.

The Henslow Sparrow is a tolerably common summer resident in some portions of the state and appears to be rare in others. J. A. Allen noted the species as less common than the Grasshopper Sparrow in western Iowa, frequenting the same situations (Mem. Bost. Soc., i, 1868, p. 495). T. M. Trippe found it common and breeding in Decatur and Mahaska counties, frequenting the edges of hazel copses (Proc. Bost. Soc., xv, 1872, p. 237).

County records: Dallas—"taken in spring of 1895 at Perry" (J. E. Law). Grundy—"one nest found and female shot in 1899" (Bingaman). Johnson—a specimen taken at Tiffin, Iowa, in the Bond collection, University museum (Anderson). Lee—"summer resident, not common" (Currier); "scarce summer resident; breeds,—Keokuk district" (Praeger). Linn—"tolerably common summer resident. I found about ten pairs of these birds in 1900 breeding in a small patch of hazel and blackberry briars, perhaps about a half acre in extent, and shot one for identification. All had young" (Berry). Poweshiek—"tolerably common summer resident" (Kelsey); "almost common at Grinnell during the whole summer" (Lynds Jones). Pottawattamie—"scarce migrant. I have no specimens but identified those killed to be the eastern bird" (Trostler).

Mr. L. Jones states that in Iowa the favorite resorts of this sparrow during the breeding season are neglected fields and pasture lands. Its nest is placed on the ground, sometimes in a slight depression beneath a tussock of grass. The composition is of fine and coarse grasses, with a few cow-hairs. The eggs are deposited about May 25 (Davie's Nests and Eggs of N. A. Birds).

245. (548). *Ammodramus lecontei* (Aud.). Leconte Sparrow.

The Leconte Sparrow is a regular and probably a rather common migrant through Iowa. It appears in the latter part of March and in April, and in September and October. It is seldom seen on account of its habit of skulking in the thick dead grass along the borders of sloughs and in low places. It seldom rises unless almost stepped on, flies a short distance, dropping out of sight again in the dense grasses.

County records: Buena Vista—"at Storm Lake, Iowa, during the latter part of September, 1887, Dr. A. K. Fisher found Leconte's Sparrow common and secured specimens not yet out of 'first plumage,' showing that they had been hatched in the neighborhood—Dr. C. H. Merriam" (Cooke, Bird Migr. in Miss. Val., p. 191). Hancock—one shot Oct. 9, 1898; saw one Sept. 11, 1902 (Anderson). Jasper—Newton, 1875 (Coues' Key, 5th Ed., i, p. 411). Johnson—a specimen taken at Tiffin, Iowa, in Bond collection, University museum. Shot one male near Iowa City, March 29, 1901 (Anderson). Lee—"common migrant" (Currier); "irregular migrant" (Praeger). Linn—"rare migrant" (Berry). Polk—"a specimen taken April 19, 1886, now in Iowa Agri. museum at Ames" (W. A. Bryan, Iowa Orn., i, 1, 1894, p. 5). Poweshiek—"I took but one specimen" (L. Jones). Story—"twenty-two specimens taken in a small slough at Colo, Story county, in October, 1876" (H. B. Bailey, Bull. Nutt. Club, ii, 1, 1877, pp. 26–27). Webster—"common" (Somes). Winneshiek—"shot one Oct. 3, 1896; saw several others at the same time" (Smith). Winnebago—shot one adult male Oct. 15, 1892; a juvenile specimen in yellowish plumage Sept. 10, 1896; adult male and female Oct. 2, 1896; male April 9, 1897 (Anderson).

246. (549.1). *Ammodramus nelsoni* Allen. Nelson Sparrow.

This interior representative of the Sharp-tailed Sparrow "breeds in the marshes of the interior from northern Illinois

northward to Dakota and Manitoba, according to various authorities. It does not appear to be common anywhere, and there is only one published record of its occurrence in Iowa.

Dr. Paul Bartsch took an adult male specimen October 12, 1894, in an old stubble field bordering the Iowa River, opposite Regan's Park, Iowa City, Iowa ("*Ammodramus nelsoni* in Iowa," Auk, xvi, 1899, pp. 276–7). G. H. Berry reports the species as a "rare summer resident" in Linn county, but has taken no specimens.

On May 27, 1904, while wading in shallow water along the edge of a slough near Coralville, Johnson county, I caught frequent glimpses of a small bird bobbing up in the sedge, and finally shot it—a male *nelsoni*. A little farther on saw another one, still shyer, which finally flew out on the closely cropped pasture near the edge of the slough, where the grass was almost too short to conceal anything. The bird would crouch down at intervals and then run along the ground with great speed, almost like a mouse, until stopped with a load of dust shot. This proved to be a female *nelsoni*. Both birds were very quick and nervous in their actions, and hardly remained still for a second at a time.

Genus CHONDESTES Swainson.

247. (552). *Chondestes grammacus* (Say). Lark Sparrow.

The Lark Sparrow is a common summer resident in all parts of Iowa from the latter part of April until October, frequenting roadsides, pastures and fields, where it nests on the ground. Two broods are reared in a season, in May, June and July.

The Lark Sparrows are not shy and the song is sweet and pleasing, resembling that of the Vesper Sparrow. The species is most common in the west, being rare east of Illinois. The type specimen, described by Thomas Say, was shot at Belle Fontaine on the Missouri, and they were subsequently observed at Engineers' Cantonment (Long's Exp., 1819–20, Vol. i, p. 321). In 1868, J. A. Allen noted the Lark Sparrow in western Iowa as "not abundant, yet at times rather frequently met with; a true prairie bird as often seen out on the wild prairie as elsewhere" (Mem. Bost. Soc., i, 1868, p. 495). At the present time it seems to be more a bird of the cultivated fields, pastures and clearings.

The Western Lark Sparrow (*C. g. strigatus*) does not appear to

be found in Iowa. Robert Ridgway identified several specimens taken at Sioux City in June as typical *grammacus*.

Genus ZONOTRICHIA Swainson.

248. (553). *Zonotrichia querula* (Nutt.). Harris Sparrow.

The Harris Sparrow or Black-hooded Sparrow is a regular and common migrant, both spring and fall, in the western and middle portions of the state, but is rare and irregular in the eastern third of the state, although it has been taken in nearly every county, and occasionally straggles to Wisconsin and Illinois. The species was formerly accounted rare. Baird, Brewer, and Ridgway (N. A. Birds, Land Birds, i, 1875, p. 578) state that "since 1840 but little information has been obtained in regard to their general habits, their geographical distribution, or their mode of breeding, single specimens only having been taken at considerable intervals in the valley of the Missouri and elsewhere until 1872 . . . . More recently this bird was taken twice by Mr. H. W. Parker in Jasper county, Iowa. The latest of these was secured May 19."

On May 13, 1834, Prince Maximilian observed the Harris Sparrow between the mouth of Boyer's Creek and the Platte River (Reise, ii, 344); he considered the species as new and described a specimen as *Fringille comata* (*Ibid.*, p. 352).

In Winnebago and Hancock counties I have found the species to be a common migrant, often abundant in the fall, from September 26 to October 26 and from April 5 to May 12 (Davies' Nests and Eggs of N. A. Birds, p. 377). In October I have heard them utter a quite loud but rather pleasing song of a few notes, repeated at short intervals. Spring and fall plumages differ considerably, the black being much obscured, and the birds in general being suffused with rich brown, in autumn.

In eastern Iowa the species is rarely seen: Johnson—four taken by Bartsch October 28, 1893; observed once in October, 1905, by myself (Anderson). Lee—"rare" (Currier, Praeger). Scott—"one shot April 16, one May 3, 1891—only records" (Wilson). Winneshiek—"three records—small flock May 14, 1895; two May 19, 1895; one Sept. 23, 1895" (Smith). Van Buren—"very rare" (W. G. Savage). Records from central and western Iowa are very abundant.

The species possessed unusual interest for many years from the

fact that its nest, eggs, and breeding habits were unknown. E. A. Preble first found the adults of both sexes and young just from the nest, July 23 to 30, 1900, at Fort Churchill, on the west shore of Hudson Bay, frequenting dwarf spruces in small valleys and ravines (N. A. Fauna, 22, Biol. Surv., 1902, p. 120).

249. (554). *Zonotrichia leucophrys* (Forst.). White-crowned Sparrow.

This large, handsome Sparrow is a rather uncommon migrant in most parts of Iowa, although generally distributed, but becomes fairly common at times. They have been noted in Iowa from April 5 to May 23 and from September 26 to October 26. They usually appear a little later than *Z. albicollis*, but the two species are frequently seen together, frequenting the same situations—the borders of woods, thickets and hedge-rows, where it sometimes utters a rather pleasing song in the springtime. The White-crowned Sparrow breeds, principally, north of the United States and has not been observed in Iowa in summer.

250. (554a). *Zonotrichia leucophrys gambeli* (Nutt.). Intermediate Sparrow.

The Intermediate or Gambel Sparrow resembles the preceding very much, but is distinguished by having the lores gray or ashy, continuous with white stripe over eye, the black of forehead not descending to eye. The species has been rarely taken in Iowa during migrations. Ridgway gives its range as "straggling eastward across the Great Plains to E. Texas, Kansas, Iowa and Minnesota (Minneapolis)" (Bds. N. and Mid. Am., i, 340).

T. M. Trippe first records it from Iowa: "*Zonotrichia Gambellii*. A specimen shot in spring, in Decatur county, agrees precisely with Baird's description" (Proc. Bost. Soc., xv, 1872, p. 273). John Krider states: "In the month of May, 1875, I shot two specimens in Iowa, the first of this bird I ever met with" (Forty Years' Notes, p. 47). W. W. Cooke (Bird Migr. in Miss. Val., 1884–85, p. 196) says: "A single specimen was reported from Iowa years ago . . . It is the more liable to be overlooked, as it arrives after the other (*Z. leucophrys*) and without close examination is naturally mistaken for it."

Dr. I. S. Trostler writes that the species is a common migrant in Mills and Pottawattamie counties. Two specimens in my col-

lection, one female, taken October 5, 1894, and one male, October 3, 1896, at Forest City, Winnebago county, were identified by Robert Ridgway.

251. (558). *Zonotrichia albicollis* (Gmel.). White-throated Sparrow.

The White-throated Sparrow is an abundant spring and fall migrant in all parts of the state. They have been noted from March 17 to May 23 and from September 18 to October 30. I shot one female at Iowa City on May 20, 1894, a week after the bulk had gone north. In April and October they are most abundant, often the most common bird, in large scattered flocks, frequenting low bushes, shrubbery and hedge-rows, spending much time on the ground among dead leaves. In late spring the familiar song note of *pea-peabody, peabody, peabody,* is often heard, giving rise to the common name of "Peabody-bird." The only report of its occurrence in summer came from G. H. Berry of Cedar Rapids, who says: "All through June and July, 1905, I could hear one or two of these sparrows in a swamp near here, and think either they bred here or else they were bachelors that remained here."

Genus SPIZELLA Bonaparte.

252. (559). *Spizella monticola* (Gmel.). Tree Sparrow.

The Tree Sparrow is an abundant winter visitant in all parts of Iowa. The species is abundant from October to April in the central and southern parts of the state, and while flocks remain throughout the winter in all portions of the state, in northern Iowa they are less common in mid-winter than during the migrating seasons. They remain in scattered flocks, feeding almost entirely upon the seeds of various weeds, and seem to find enough of these projecting above the snow to support them even in the severest weather. Towards spring they become quite musical and sing a sweetly modulated but rather feeble song.

The Tree Sparrow resembles the Chipping Sparrow in general appearance, but is somewhat larger, with a conspicuous dusky spot on the otherwise unmarked breast.

253. (560). *Spizella socialis* (Wils.). Chipping Sparrow.

The Chipping Sparrow, "Chippy," or "Hair-bird," is a com-

mon summer resident in all parts of the state from about the first week in April until the middle of October. It is an inconspicuous bird with a rather high-keyed monotonous song, *chippy-chippy-chippy*, often repeated. It nests commonly about houses, in trees and shrubs, or in low bushes in open woods, building a nest of fine dried grass, lined with horse-hair. The eggs are laid from the first week of May until July.

Although the species was found here before the settlement of the state, being noted by Thomas Say at Engineers' Cantonment in 1819–20 (Long's Exp., i, p. 264), and by Audubon near Council Bluffs, May 10, 1843 (Journals, i, p. 481), the species has undoubtedly increased in numbers with the cultivation of the land and the growth of artificial shrubbery. In 1868 J. A. Allen noted the species as rather rare in western Iowa as well as in Illinois, only observed about the settlements (Mem. Bost. Soc., i, 1868, p. 446).

In some localities the species seems to be less frequent about towns than it was a few years ago, however, owing to persecution by the omnipresent and pugnacious English Sparrow.

254. (561). *Spizella pallida* (Swains.). Clay-colored Sparrow.

The Clay-colored Sparrow is a bird of the central region of the United States and British America, east to Iowa and Illinois. It is reported from nearly all parts of the state as a migrant, rare in most localities in eastern Iowa, and tolerably common in central and western Iowa, migrating in the latter part of April, more numerously in early May and during September and October.

It is found rather sparingly as a summer resident in the northern part of the state and a few nests have been found. J. W. Preston found it breeding in Winnebago county in June, 1885, frequenting the edges of brush and timber. The nests were placed on the ground; one, however, was built in the branches of a low hazel. The materials used in the construction of the nests were fine, round grasses and blades, with a lining of hair; eggs three to five, usually four, similar in size and color to those of the Chipping Sparrow (Davie's Nests and Eggs of N. A. Birds, 1889, p. 308; 5th Ed., 1898, p. 380). A set of four eggs were taken at Lake Mills by J. Eugene Law, birds identified by Lattin. I have frequently seen the birds in summer in Winnebago and

Hancock counties, usually in low hazel thickets. In September and October, 1896, the Clay-colored Sparrows were abundant around Forest City. H. J. Giddings gives the species as a rare summer resident, a few nesting, in Jackson county; and W. H. Bingaman as a common migrant and rare breeder in Kossuth.

255. (563). *Spizella pusilla* (Wils.). Field Sparrow.

The Field Sparrow is a common summer resident in all parts of Iowa, arriving during the last week of March or first of April and remaining until the middle of October. It is more a bird of pasture lands and the borders of thickets than of the fields, nesting, usually, upon the ground, but sometimes in low bushes. Two broods are raised in a season, and eggs have been found from May 1 to July 26. Morton E. Peck says that the Field Sparrow is "one of the few Iowa birds that seems to have become more abundant within the last twenty or thirty years."

Genus JUNCO Wagler.

256. (567). *Junco hyemalis* (Linn.). Slate-colored Junco.

The Slate-colored Junco is a very abundant migrant in all parts of the state, usually arriving from the north in large numbers about the first of October and the bulk leaving the state by the first week of May. Dr. C. C. Smith has noted them at Decorah as early as September 16 and as late as May 16. The Junco is a common winter resident from the central part of the state southward, but is most abundant in October, November, March, and April. It is a sprightly and familiar bird, frequently appearing in door yards, and readily known by its slate-colored back, head and breast, white belly and white outer tail feathers. This species is the bird commonly called the "Snowbird."

257. (567.1). *Junco montanus* Ridgw. Montana Junco.

To this newly described species should probably be referred all the Mississippi Valley records of Juncos outside of the typical Eastern *hyemalis*,—(*J. h. oregonus* Towns., *J. shufeldti* Coale, and *J. h. connectens* Coues). Its geographical distribution is given in the 9th Supp. A. O. U. Check List (Auk, xvi, 1899, p. 110) as: "Northwestern Montana and northern Idaho, north to Alberta; in winter south to northern Mexico, Texas, etc., and east, irregularly or casually, to the Mississippi Valley, and even to Indi-

ana." A single specimen was taken at Delevan, Wis., October 20, 1898, and pronounced typical by Wm. Brewster (Bds. of Wis., pp. 100–1).

Wm. E. Praeger states: "On the 16th of December, 1892, I shot a specimen of *J. hyemalis shufeldti* on the Illinois shore just opposite this city (Keokuk, Iowa). It was with several Juncos, all, as far as I could tell, of the common variety" (Auk). R. Ridgway refers this record to *Junco montanus* (Bds. N. and Mid. Am., i, p. 291). E. S. Currier reports it from Hancock county, Ill. (opposite Keokuk), and G. H. Berry reports it as a spring and fall migrant in Linn county. Mrs. Mary L. Raun of Manchester writes: "The bird I have called the Pink-sided Junco I have seen with one flock of Juncos several times. Its markings are decidedly pink in the spring, extending from the edge of the wing toward the breast" (Delaware county).

Genus MELOSPIZA Baird.

258. (581). *Melospiza cinerea melodia* (Wilson). Song Sparrow.

The Song Sparrow is a common migrant in all parts of the state, a common summer resident from the south-central part of the state northward, a common winter resident in southeastern Iowa (Lee county), and occasional in winter as far north as Iowa City (Johnson county). In Winnebago county it is an abundant summer resident, nesting through May, June and July, usually on the ground in thickets near streams. The bulk of the Song Sparrows arrive from the south in March and depart in October. It is a very pleasing and melodious songster, at all hours of the day and at any season.

In 1872, T. M. Trippe recorded the Song Sparrow as abundant in spring and fall in Decatur and Mahaska counties, but not observed to breed. They were shy and retiring, in complete contrast to the habits of the Eastern Song Sparrow (Proc. Bost. Soc., xv, 1872, p. 237). The species seems to have increased in numbers and become more familiar in its habits since the settlement of the state.

259. (583). *Melospiza lincolni* (Aud.). Lincoln Sparrow.

The Lincoln Sparrow is only found in Iowa as a migrant, appearing from the latter part of April to the middle of May and

from the latter part of September to the end of October. It is a shy species, skulking in dense weeds and bushes, and seen much less frequently in spring than in fall. The species is generally distributed over the state, in most localities being considered rare, but tolerably common at other points. They were very common at Forest City during the month of October, 1896, in company with Clay-colored and White-throated Sparrows.

260. (584). *Melospiza georgiana* (Lath.). Swamp Sparrow.

The Swamp Sparrow is a common migrant in all parts of the state, but is seldom seen on account of its shy and retiring habits; most common in April and October, although they have been reported as early as May 25 (Scott) and as late as October 29 (Polk). A few remain during the summer in various parts of the state, although by far the greater number go further north to breed. Although usually found in wet meadows or along reedy streams, the Swamp Sparrow occasionally is found in dry fields or thickets. It is reported as a rare summer resident in Boone (Henning); Jackson, "common summer resident" (Giddings); Kossuth (Bingaman); Lee (Currier); Linn (Berry); Van Buren (Wm. Savage); Winnebago (Anderson); Winneshiek (Smith); Dickinson—common, Aug. 18, near Spirit Lake (Anderson).

Genus PASSERELLA Swainson.

261. (585). *Passerella iliaca* (Merrem). Fox Sparrow.

The Fox Sparrow is one of the most abundant as well as one of the largest and handsomest Sparrows found in Iowa during the migrations. It is not known to breed within the United States. The extremes of migration given are March 12–April 23, and September 25–November 25, in Scott county (Wilson). In Winnebago county I have found them, usually, most abundant during the first week of April and first week of October. It generally frequents thickets and hedges, rustling for most of its food among the dead leaves which cover the ground at that season.

Genus PIPILO Vieillot.

262. (587). *Pipilo erythrophthalmus* (Linn.). Towhee.

The Towhee or Chewink is a common summer resident in nearly all portions of the state and abundant in some localities. Wm.

Savage reports that a few stay throughout the winter in Van Buren county (Iowa Orn., i, 1, 1894, p. 9). B. H. Wilson has also noted a female around Rock Island Arsenal in winter, his only winter record. Chas. Aldrich notes a Towhee wintering at Webster City, enduring weather from 20° to 35°, and very tame; killed by a Blue Jay on January 18 (Am. Nat., xix, 1885, pp. 513–14). In Winnebago and Hancock counties a few are seen in spring and fall, but I have never observed the species in summer. The Towhee frequents thickets, underbrush, and bushy clearings, where the nest is placed on the ground or in a small bush. Two broods are usually reared, "the first set laid in first half of June, the second, in first week in August, Linn county" (Keyes). David L. Savage found a nest in Henry county, May 17, 1893, which contained three eggs of the Towhee and five eggs of the Cowbird (Oölogist, x, 12, 1893, 325).

Prince Maximilian noted the species as common at various points along the Missouri. At the mouth of the Little Sioux River, on May 11, 1834, he writes: "An den freien Weisenplätzen fanden wir überall den rothaügigen Fink (*Fring. erythrophthalma*), einen der gemeinsten Vögel von Nord Amerika" (Reise, i, p. 287).

The Towhee usually arrives in the latter part of March, departing in October.

Genus CARDINALIS Bonaparte.

263. (593). *Cardinalis cardinalis* (Linn.). Cardinal.

The Cardinal is one of the birds which seems to be extending its range northward in Iowa. W. W. Cooke states: "South of latitude 41° it is stationary, while north of this parallel some remain in the winter, but most go south . . . the most northern record received was from Iowa City, where one was seen April 17, but it may have been an escaped cage bird. In the spring of 1885 two Cardinals were seen in January at Morning Sun, but they were not recorded during the winter of 1884–85 from any other place in Iowa. They returned to Ferry, Iowa, March 29, and to Denmark, Iowa, April 19. In the fall of 1885 a Cardinal was taken at Iowa City October 29, being the first one captured in that county that was certainly a wild bird" (Bird Migr. in Miss. Val., 1884–85, pp. 215–16). Henry A. Berry reported a specimen taken in a box trap at Iowa City in February, 1882 (O.

and O., vii, 1882, p. 174). Keyes and Williams state that it is only occasionally seen in central Iowa, but noticed more often in the southern part of the state (Birds of Iowa, 1889, p. 145).

At the present time the Cardinal appears to be more abundant in Iowa than formerly, and certainly occurs further north, as the following reports testify:

Blackhawk—"twenty years ago it was considered accidental in Blackhawk, but at present it is frequently seen there, especially in winter. No nest from that locality, however, has yet been recorded" (Peck). Des Moines—"common permanent residents at Burlington, frequenting the undergrowth along the bluffs during the breeding season and coming to the back doorsteps in winter to eat table crumbs" (Sloanaker). Jackson—"rare transient" (Giddings). Johnson—rather rare but constant resident at Iowa City; most frequently observed in winter (Anderson). Jasper—"have seen only one specimen, at Colfax, Aug. 5, 1902" (Sloanaker). Linn—this species has extended its range to our latitude the last three years. Many persons have observed them here since the summer of 1901, and I have myself seen males here during the fall and winter of 1903-04" (Keyes). Lee—"common resident" (Praeger, Currier). Polk—"rare; winter" (Johnson). Mahaska—"very common; nesting in low bushes" W. A. Bryan, Iowa Orn., i, 1, 1894, p. 9). Webster—"few" (Somes). Woodbury—"comparatively recent visitor here. Only noticed in the last few years" (Rich). A male specimen was sent to the University by D. H. Talbot, killed at Sioux City, March 28, 1904. B. H. Wilson reports the Cardinal as resident at Rock Island, becoming more abundant every year. Warren—"tolerably common resident, found only in a certain locality about six miles from Indianola" (Jeffrey).

Genus ZAMELODIA Coues.

264. (595). *Zamelodia ludoviciana* (Linn.). Rose-breasted Grosbeak.

The Rose-breasted Grosbeak is an abundant summer resident and breeds in all parts of the state. It arrives from the south early in May, sometimes the last of April, the males coming a few days before the females. The males are very melodious songsters in spring, but with the beginning of summer become quiet, and

the species is very inconspicuous during the latter part of summer, departing in September. The nests are placed in trees, from eight to forty feet from the ground, usually not over fifteen feet, in almost any situation—wild crab and plum thickets, orchards, shade trees in yards, woods, or willows along streams, both in the heart of town and in secluded situations; eggs laid during last of May and first of June.

The Rose-breasted Grosbeak frequently visits berry patches and gardens and has a fondness for green peas, but it is largely insectivorous. "Prof. C. E. Bessey of the Iowa Agricultural College has noted the Rose-breasted Grosbeak's habit of feeding on the Colorado potato beetle, and this useful propensity was again remarked during the past year by a correspondent of *Forest and Stream*, of Coralville, Iowa, and by another at Ames, in the same state" (Am. Nat., xiv, 1880, pp. 521–22). On the whole, the species is beneficial and should be protected.

Genus CYANOSPIZA Baird.

265. (598). *Cyanospiza cyanea* (Linn.). Indigo Bunting.

The Indigo Bunting is a common summer resident in all parts of the state from the early part of May until the last of September. It frequents low bushes and thickets, nesting rather late, from the latter part of June until the middle of August. The later dates are probably second sets, as the birds will build second or third nests in the same vicinity if the first nest is destroyed. The nest is rather loosely and slovenly built, usually with long straws hanging down from the periphery, and seldom placed more than four feet from the ground. The eggs are from two to four in number, white or very pale bluish, unspotted, and the nest very frequently contains eggs of the Cowbird. The female is a plain brown bird, closely resembling a Sparrow, and very shy and retiring, while the male, plumaged in rich blue, delights to perch upon the topmost branch of a dead tree or on a telegraph wire and sing for hours, continuing during the whole summer.

Genus SPIZA Bonaparte.

266. (604). *Spiza americana* (Gmel.). Dickcissel.

The Black-throated Bunting or Dickcissel is an abundant summer resident in all parts of Iowa, usually arriving early in May,

sometimes in the latter part of April, and remaining until the latter part of September. It is one of the most characteristic birds of the country in summer, where the male may be heard at intervals throughout the day, even during the hottest, most sultry days of summer, perched upon a weed, a fencepost, or the topmost branch of a hedge, earnestly uttering a rather loud and scarcely musical *chip-chip-chee, chee, chee.*

This species has changed its range somewhat during recent years. It was formerly common along the Atlantic coast, but within the last thirty or forty years has become practically extinct east of the Alleghanies (Auk, xxi, 3, 1904). Its numbers appear to have changed little in Iowa since the settlement of the state. In 1868 J. A. Allen gave it as one of the most abundant birds in eastern Iowa, "eminently a prairie species, and one of the few inhabitants of the wide open stretches" (Mem. Bost. Soc., i, 1868, p. 446). Many observers give the species as building its nest on the ground, but of the dozens of nests which I have examined none were directly on the ground; a few were placed in clumps of tall grass a few inches above the ground, several in Canada thistles, and the majority in small bushes and low trees, rose-bushes, willows, wild crab, scrub-oak, wild cherry, apple trees, etc., from a few inches to three and one-half feet above the ground. July 11–12, 1902, found four nests in a young orchard, all in small apple trees two or three feet up, surrounded by tall weeds and containing eggs and young, newly-hatched young and fledged young; July 9, 1894, found four nests in small bushes; August 19, 1893, found a nest containing two eggs and two young birds; all in Winnebago county. In July, 1905, I found a number of nests in a large weed patch in Johnson county. The eggs are four or five in number and pale blue in color, very closely resembling eggs of the Bluebird.

Genus CALAMOSPIZA Bonaparte.

267. (605). *Calamospiza melancorys* Stejn. Lark Bunting.

The Lark Bunting or "White-winged Blackbird" is a bird of the western plains and rarely strays east to Iowa. Audubon observed the species at Blackbird's Hill, on the Missouri, May 13, 1843, saying: "During the wood-cutting, Bell walked to the top of the hill and shot two Lark Buntings and a Lincoln's

Finch" (Journals, i, 486). John Krider states: "*Calamospiza bicolor* Bonap.—I shot two specimens in the spring of 1875 in Winnebago county, Iowa" (Forty Years' Notes, p. 49).

Dr. I. S. Trostler reports the Lark Bunting as a "scarce summer resident" in Pottawattamie county, and G. H. Berry "shot two male birds in 1890 at Hawarden, Sioux county." Dr. G. C. Rich reports that "one male was shot west of Sioux City, in Iowa; June 6, 1897; also seen May 21, 1901. It is rare, but have seen it several times."

Dr. Hatch (Birds of Minn., 1892, p. 346) gives the species as reported by Dr. Hvoslef from Fillmore county (near the Iowa line) as late as the 19th of June, also the 12th of May; and Mr. P. Lewis in several places between the last named and Redwood, and supposes the species to breed in southern Minnesota, as the times of its observation included the earliest part of July.

Family TANAGRIDÆ. Tanagers.

The Tanagers are a distinctly American family, most abundant in the tropics. They are frugivorous and insectivorous, and usually brilliantly colored. The genus *Piranga* is distinguished from the Finches by its turgid bill, slightly notched at tip and toothed or lobed near the middle of cutting edge of upper mandible.

Genus PIRANGA Vieillot.

268. (608). *Piranga erythromelas* Vieillot. Scarlet Tanager.

The Scarlet Tanager, probably the most brilliantly colored bird found in the state, is a common summer resident in all wooded portions of Iowa from the first of May until the middle of September. The sexes are very unlike, the male bright scarlet with black wings and tail, and the female light olive-green above and greenish yellow below. The Scarlet Tanager nests in open woods, groves and orchards, building a rather flimsy nest upon a horizontal limb, from fifteen to forty feet from the ground. The eggs are three or four in number, laid during the early part of June. This species is very often imposed upon by the Cowbird.

269. (610). *Piranga rubra* (Linn.). Summer Tanager.

The Summer Tanager differs from the preceding in the rose-red or vermilion tint of its plumage, including the wings and tail; the female is brownish-olive above and dull yellow below. It is

a bird of southern distribution and is rare in southern Iowa, seldom appearing as far north as the center of the state. Keyes and Williams state that "during the season of 1889 this species was observed at Des Moines and three nests with eggs taken, but since then has not been noticed in that vicinity. One of the nests, taken July 23, contained two eggs about half incubated. The nest was placed on the horizontal limb of an elm tree in a rather open grove, and was about fifteen feet from the ground.

County records: Des Moines—"took a specimen in the spring of 1889 at Burlington" (Bartsch, Iowa Orn., i, 3, 1895, p. 64). Lee—"rare" (Praeger); "rare summer visitant; may breed" (Currier); "rare summer resident" (Berry). Marshall—"rare; only observed a few times" (A. P. Godley, Iowa Orn., i, 1895, p. 64). Scott—"not a regular bird in Scott county, and rarely seen. May, 1889, I took my first. Have never seen more than one at a time and that only in May" (J. H. Brown, Iowa Orn., i, 1895, p. 64); "rare straggler, only one seen, shot April 20, 1899" (Wilson). Van Buren—"in 1895 I shot an immature male. This is the only one I have known to occur in one vicinity" (W. G. Savage).

Family HIRUNDINIDÆ. Swallows.

The Swallows are a well-known family, distributed throughout the world. They have long, powerful wings and small, weak feet; fissirostral, with wide, deep gape, enabling them to capture insects, which form their food almost exclusively, upon the wing. They migrate usually by day.

Genus PROGNE Boie.

270. (611). *Progne subis* (Linn.). Purple Martin.

The Purple Martin is a common summer resident in all parts of the state, arriving with great regularity, usually during the first ten days of April, but a few stragglers sometimes come in the last of March. The Martins nest in bird-boxes or in cornices of buildings, returning to the same spot year after year. Of late years they have decreased in numbers in many localities, owing to the fact that the English Sparrows preëmpt their nesting-places in the early spring. Formerly the Martins nested in trees. F. V. Hayden stated that the Martin was "abundant throughout

the Northwest, along the wooded bottoms of streams, where the dry trees are its favorite breeding places" (Trans. Am. Philos. Soc., xii, 1863, p. 162). This primitive habit of nesting in hollow trees seems to have been abandoned for many years, at least in Iowa. During the latter part of August large flocks congregate, usually making their rendezvous upon the roof of some large building, or church spire, and all disappearing at once about the last of August.

The Martin is strictly insectivorous, capturing its prey on the wing. Mr. O. Widman of Old Orchard, Mo., observed a colony of sixteen pairs from 4 a. m. to 8 p. m., during which time the parents visited their offspring 3,277 times, or an average of 205 times for each pair. The males made 1,454, the females 1,823 visits (*Forest and Stream*, xxii, 1884, p. 484).

Genus PETROCHELIDON Cabanis.

271. (612). *Petrochelidon ludifrons* (Say). Cliff Swallow.

The Cliff Swallow or Eave Swallow is a common summer resident in all parts of the state from the latter part of April until September. It is rather locally distributed, remaining quite close to its breeding place, where the bottle-shaped nests are placed in large colonies under the eaves of barns and other large buildings. Before the settlement of the country this Swallow plastered its nest of mud pellets on the vertical sides of cliffs and river bluffs. Prince Maximilian noted large colonies along the Missouri River bluffs in 1833 (Reise, i, p. 90, etc.), and F. V. Hayden describes colonies along the Missouri "often covering the vertical sides of the river bluff with their nests." With the settlement of the country the species has almost abandoned the cliff-nesting habit, finding the eaves of buildings more suitable. This has resulted in a much more general diffusion of the species over the prairie country.

J. A. Allen says: "The older settlers in Dallas county told me it made its first appearance there three years before, when a colony settled in Redfield, building under the eaves of a large sandstone store. This season there were several large colonies in the same vicinity, resorting to the eaves of barns for nesting sites" (Mem. Bost. Soc., i, 1868, p. 495). Wilmon Newell reports that in Sioux county, "along the Rock and Big Sioux Rivers, these

birds build upon the faces of high perpendicular cliffs wherever these may be found. For the last three years they have increased rapidly. In the absence of any high cliffs the nest is placed under the eaves of a barn or other high building" (Iowa Orn., i, 3, 1895, pp. 65–66). The Cliff Swallows often have battles with the English Sparrows for the possession of their nests, but the Swallows usually come off victorious. The Swallows are generally welcomed about farm-yards on account of the large numbers of mosquitoes and other insects which they destroy.

Genus HIRUNDO Linnæus.

272. (613). *Hirundo erythrogastra* Bodd. Barn Swallow.

The Barn Swallow, known from the Cliff Swallow by its deeply forked tail, is a common summer resident in all parts of Iowa from the middle of April until September first. The Barn Swallow is less inclined to associate in colonies than the Cliff Swallow, and while the nest is occasionally built under eaves, it is generally placed under the roof of an open shed or outbuilding, stuck to the side of a rafter or upon the top of a horizontal beam. The nest is often placed under a small bridge. The Barn Swallow seems to have been less generally distributed in the earlier days. F. V. Hayden speaks of the species building its nests on the vertical sides of the bluffs along the Missouri in countless numbers (Trans. Am. Philos. Soc., xii, 1863, pp. 161–62). J. A. Allen stated that the Barn Swallow was not generally common in western Iowa. Sometimes none were seen for long intervals. In some sections persons who had resided there for years claimed never to have seen them (Mem. Bost. Soc., i, 1868, pp. 494–95). T. M. Trippe reported that they were not seen in Mahaska county, and only observed in a single locality in Decatur county, where a single pair had appeared five or six years before and increased to a colony of thirty or forty (Proc. Bost. Soc., xv, 1872, p. 225). At the present time there is scarcely a farm in the state that does not have one or more pairs of Barn Swallows nesting in its buildings.

Genus IRIDOPROCNE Coues.

273. (614). *Iridoprocne bicolor* (Vieillot). White-bellied Swallow.

The White-bellied Swallow or Tree Swallow is a common migrant in most parts of the state and a tolerably common summer

resident in many localities, but appears to breed rather locally. It is the earliest Swallow to migrate in spring, arriving in the latter part of March or first of April, and remaining in the fall until the latter part of September.

In Jackson county H. J. Giddings reports that it "nests in holes in trees and stubs. Have never found a nest except near water. Breeds plentifully along the sloughs and lakes bordering the Mississippi River." Blackhawk—"common migrant; rather rare breeder" (Peck). Lee—"rare summer resident; common migrant" (Praeger, Currier). Mills—"common summer resident" (Trostler). Scott—"common summer resident" (Wilson). Polk—"common summer resident; nests" (Johnson). Woodbury—"common summer resident; nests" (Rich). Winnebago—found one nest June 4, 1894, in the top of an old pump, standing in a foot of water in a slough; four pure white eggs. In August the species becomes very abundant, and hundreds may be seen in rows upon the telegraph or telephone wires in the country (Anderson). Other observers report the species only as a migrant.

Genus CLIVICOLA Forster.

274. (616). *Clivicola riparia* (Linn.). Bank Swallow.

The Bank Swallow or "Sand Swallow" is an abundant summer resident in Iowa from the latter part of April until the middle of September. It breeds abundantly in large colonies wherever suitable banks or cuts are found in which the nesting burrows can be excavated. These are usually dug in the vertical side of the clayey banks of streams, but any suitable bank in a railroad cut or sand-pit may be tenanted by them. Sometimes a bank will be literally honeycombed with the burrows, which vary from a few inches to three feet in depth, enlarged at the further extremity, in which five or six white eggs are laid upon a few grasses and feathers. This species is often confused with the Rough-winged Swallow, but may be readily distinguished by its dusky pectoral band contrasting with whitish under parts. The only Iowa locality from which the species was not reported was Winneshiek county, Dr. C. C. Smith reporting that all the birds he had shot were of the Rough-winged species. In Winnebago, Hancock, and Johnson counties I have found the Bank Swallows nesting in very large colonies.

Genus STELGIDOPTERYX Baird.

275. (617). *Stelgidopteryx serripennis* (Aud.) Rough-winged Swallow.

The Rough-winged Swallow is a tolerably common summer resident in most parts of the state. It resembles the Bank Swallow in general appearance and habits, but lacks the whitish under parts and dark pectoral collar. The hooklets of the outer primary are only fully developed in adult birds. Keyes and Williams state that "in central Iowa, especially in Polk and the contiguous counties, this species is quite abundant, almost to the exclusion of the Bank Swallow. The nests are usually built in the alluvial banks of the streams or in the sides of gravel pits and in road cuts" (Birds of Iowa, 1899, p. 148). From the fact that the species is reported rare or absent in many places and common in similar and adjacent localities, it is probable that the Rough-winged Swallow is often confounded with the Bank Swallow. The Rough-winged Swallow does not always nest in holes in banks, but sometimes nests about bridges and abutments. In Linn county Dr. B. H. Bailey states: "I have found four nests in the last four years, three of which I think were by the same pair of birds, under a bridge over a creek."

In Johnson county I have frequently seen the birds in spring, excavating burrows in the lœss banks along roads, but never more than two or three pairs together.

Famiy AMPELIDÆ. Waxwings.

The two species of this family which are found in Iowa are cinnamon-tinted birds with soft, silky plumage, conspicuous crests, tail yellow-tipped, and tips of primaries, and sometimes rectrices, usually with a small red "sealing-wax" appendage. They are chiefly frugivorous, feeding on berries, but are also largely insectivorous in summer.

Subfamily AMPELINÆ.

Genus AMPELIS Linnæus.

276. (618). *Ampelis garrulus* Linn. Bohemian Waxwing.

The Bohemian Waxwing is at times an abundant winter resident in Iowa, but is an erratic wanderer and its appearance and

distribution are very irregular. They have been reported from nearly all portions of Iowa but are most commonly observed in the northern part of the state. Large flocks appear some winters and may remain in a neighborhood for months, feeding principally upon hackberries, bittersweet berries and the fruit of the mountain-ash tree. They may appear for several winters in succession and then absent themselves for an equally long period. The earliest date I have seen them was November 24, 1894, when two were seen; a large flock seen December 16, 1891, and from January 24 to 31, 1892, a large flock remained in Forest City, feeding upon mountain-ash berries in dooryards. Dr. C. C. Smith shot one from a large flock, March 18, 1896, the first time he had observed the species. Since then he has many times observed large flocks. The Bohemian Waxwing has been observed in Iowa City on a number of occasions. They are usually quite tame and unsuspicious.

277. (619). *Ampelis cedrorum* (Vieill.). Cedar Waxwing.

The Cedar Waxwing, Cedar-bird, or Cherry-bird is common in all parts of Iowa. While it is most common during the migrating season, large flocks are apt to appear in any month of the year, and a few remain to breed. Flocks are most frequently seen in February and March, and during the cherry season they usually do not fail to visit the orchards. In winter, the bittersweet and mountain-ash and cedar-berries are favorite foods. The Cedar-birds nest later in the season than most birds, usually in July and August, building indiscriminately in shade trees, orchards, or on the borders of woods and streams. Paul Bartsch records a set of eggs taken May 26, 1888, in an apple tree, at Burlington, and C. F. Henning a set taken June 15, 1890, in Boone county. Bartsch states that at times they nest quite commonly in willows bordering the Mississippi (Iowa Orn., i, 4, 1895, pp. 83–85). Though the Cedar-birds at times consume quantities of cherries and other small fruits, they destroy many noxious insects, particularly canker-worms in orchards. J. Eugene Law says: "A pair built two nests and raised two broods, one year, in our yard in the center of Forest City, Iowa; the first nest was within one rod of the house" (Iowa Orn., i, 1, 1894, p. 26). I have found fresh eggs at Forest City in June, and as late as August 8 (Winnebago).

Family LANIIDÆ. Shrikes.

The Shrikes or Butcher Birds are passerine birds with hawk-like proclivities, preying chiefly upon mice, small birds, and insects, which they have the habit of impaling upon thorns, sharp twigs or barb-wire fences. Their clearly massed colors of black, white and cadet gray render them easily distinguishable.

Genus LANIUS Linnæus.

278. (621). *Lanius borealis* Vieill. Northern Shrike.

The Northern Shrike is a common winter resident in all parts of the state. It usually appears during the latter part of October and remains until March, having been observed as early as October 20 and as late as April 3. The English Sparrow is frequently captured by the Northern Shrike, but Tree Sparrows and Juncos are also destroyed. H. J. Giddings has noticed them frequently on the ground picking up insects, and once during a warm spell in February saw one catching large insects on the wing, capturing twenty-five in the short time that he watched it. This species frequently enters towns in winter in pursuit of Sparrows and seem to be quite fearless.

279. (622a). *Lanius ludovicianus excubitorides* (Swains.). White-rumped Shrike.

The status of the two summer-resident forms of Shrikes in Iowa is an unsettled question. Most recorders refer to the breeding birds as White-rumped and Loggerhead Shrikes rather indiscriminately, and the records are therefore of doubtful value.

Ridgway (Bds. N. and Mid. Amer., iii, p. 246) describes *excubitorides* as "similar to *L. l. migrans*, but gray of upper parts decidedly paler; changing abruptly to white on upper tail coverts; white of scapulars more extended (occupying practically the whole of scapular region) and more abruptly contrasted with gray of back; forehead and supraloral region paler gray than crown, sometimes whitish; under parts pure white; size averaging slightly larger."

T. M. Trippe (Am. Nat., 1873, p. 497), writing before the form *L. l. migrans* was elaborated, states: "In a residence of two years in central and southern Iowa (Decatur and Mahaska counties) I killed a large number of Shrikes, and although the larger

number were plainly referable to *Collurio excubitorides*, there were some that I could not satisfactorily place as belonging either to *C. excubitorides* or *C. ludovicianus* . . . While occasional observations or observations for a limited space of time, would probably result in the conclusion that *C. excubitorides* was the only form, close and extended observation would show a variation in many cases toward the *C. ludovicianus* type, while rarely a specimen would be found that would appear absolutely of that species."

The White-rumped Shrike is reported by observers as a tolerably common summer resident in all parts of the state, but it appears to be less common in the northern part of the state. The nest is usually placed in osage-orange hedges in central and southern Iowa, while north of the osage-hedge districts it is placed in willows along country roads or in isolated trees in pastures. Most of the White-rumped Shrike records from Iowa should undoubtedly refer to the Migrant Shrike.

280. (622e). *Lanius ludovicianus migrans* Palmer. Northern Loggerhead Shrike.

The Northern Loggerhead Shrike is described by Ridgway (Bds. N. and Mid. Amer., iii, p. 243) as "practically identical in coloration with *L. l. ludovicianus*, but gray of upper parts averaging slightly paler (especially the gray along upper margin of the black loral space) and under parts less purely white, etc. . . bill much smaller and the tail decidedly shorter than wing, instead of the reverse" . . . Range—"Greater part of United States east of the Great Plains . . . breeding north to New Brunswick . . . Michigan, Wisconsin and Minnesota, and southward to midland Virginia and western North Carolina, Kentucky and eastern Kansas, etc."

Bruner, Wolcott and Swenk give the Migrant Shrike as occurring regularly in eastern Nebraska, but only locally common. The White-rumped Shrike occurs over the entire state. Both varieties are reported from Omaha, Lincoln, Beatrice, etc. (Rev. Bds. Neb., 1904, p. 95).

In Lee county W. E. Praeger reports all his records as of *ludovicianus*, and none of 622a, but is not certain that it does not occur. E. S. Currier states: "I have seen birds that I could call *L. excubitorides*, and others that I could not. The common bird is

not strictly either. The conspicuously *White-rumped* form is not the abundant bird near Keokuk, but does occur."

I have examined two specimens in the Coe College collection, taken by Dr. B. H. Bailey, one near Rockwell (Cerro Gordo county), July 5, 1902, and one taken August 3, 1902, in Sac county, which are typical *migrans*, with breast plain, and rump *not pale;* two others, one taken near Traer, June 20, 1902, and one between Chapin and Rockwell, July 5, 1902, are more like *excubitorides*, with breast faintly barred and rump paler.

Dr. I. S. Trostler reports that he took a set of six eggs and killed female bird May 16, 1897, in the south part of Pottawattamie county.

It is probable that the majority of the summer-resident Shrikes in Iowa, particularly in the eastern portions of the state, belong to the form *migrans*, but the form has been so recently elaborated that the majority of observers have not differentiated it from the *excubitorides* type. (See W. Palmer, "Northern Loggerhead Shrike," Auk, xv, July, 1898, p. 248).

Family VIREONIDÆ. Vireos.

The Vireos or Greenlets resemble "small, insectivorous Shrikes." They feed upon small insects, which they diligently gather from the surfaces of leaves, being most frequently hidden in the leaves at the tips of branches. The nest is pensile, hung between the forked branches of a small limb. All the species are pleasing singers.

Genus VIREO Vieillot.

Subgenus VIREOSYLVA Bonaparte.

281. (624). *Vireo olivaceus* (Linn.). Red-eyed Vireo.

The Red-eyed Vireo is a common summer resident in all parts of the state from the first of May or latter part of April until early in October, although it is more abundant as a migrant. The nest is a pensile structure, hung from ten to thirty feet from the ground, and the eggs are laid in the early part of June. The Red-eyed Vireo is an incessant songster at all hours of the day, and through the hottest days of summer its rambling, discursive warble may be heard in woodlands. It is also found commonly in shade trees on lawns and in orchards.

282. (626). *Vireo philadelphicus* (Cass.). Philadelphia Vireo.

The Philadelphia Vireo is apparently quite rare in Iowa or else is generally overlooked by observers, owing to its close resemblance to the Warbling Vireo. Keyes and Williams gave the species as "migratory; common; arriving the second week in May. It first appears in scattered companies, moving in leisurely flights through the tops of the trees along the water courses, and associating with various species of Warblers. In the fall it appears about the first of September" (Birds of Iowa, 1889, p. 150).

County records: Jackson—"Mr. Giddings thinks it may breed in Jackson county—noted three during breeding season; very rare, seen only a few times. First seen in 1895 on June 1" (Iowa Orn., ii, 2, 1896, p. 42). Johnson—shot one female May 20, 1904, at Iowa City (Anderson). Linn—"tolerably common migrant" (Berry). Scott—"tolerably common migrant, May 11–20, Sept. 21–28" (Wilson); "Mr. J. H. Brown finds it not uncommon in Scott county, in some seasons a quite common migrant" (Iowa Orn., ii, 2, 1896, p. 42). Woodbury—Dr. G. C. Rich sent me for identification a specimen shot by Lloyd Brown at Morningside, Sioux City, Iowa, May 11, 1903. Winnebago—shot a female at Forest City, Aug. 31, 1901, in a small hazel thicket in a pasture (Anderson).

283. (627). *Vireo gilvus* (Vieill.) Warbling Vireo.

The Warbling Vireo is a common summer resident in nearly all parts of the state, arriving in the latter part of April or first of May, and departing early in September. It is generally a little less common than the Red-eyed Vireo, which it resembles in habits. Its nest is built higher than most of the Vireos, from twenty to forty feet from the ground, suspended at the extremity of a branch of a maple or elm tree in the dooryard or along the street, or in woodland. It is a beautiful singer. Chapman compares it with the Red-eye: "Instead of the Red-eye's broken, rambling recitation, the song of the Warbling Vireo is a firm, rich, continuous warble with a singular alto undertone" (Bds. E. N. A., p. 330). When the nest is approached the birds have a rather harsh, squeaky, complaining note. The nest is difficult to observe from the ground, being generally concealed by dense foliage. On one occasion I found the Warbling Vireo's nest by

climbing up to a Robin's nest which chanced to be near it. The usual nesting date is about June 20 in northern Iowa.

Subgenus LANIVIREO Baird.

284. (628). *Vireo flavifrons* Vieill. Yellow-throated Vireo.

The Yellow-throated Vireo is reported as a tolerably common summer resident in most portions of the state, and rather rare in others. It appears to be less common than either the Red-eyed or Warbling Vireo, although its bright yellow breast makes it conspicuous. It is a less pleasing singer than either of the preceding species, and has the habit of greeting the intruder into its haunts with a peevish, scolding note, particularly if near the nesting site. The only nest I ever found was at Forest City, June 18, 1891, containing four eggs of the Vireo and one of the Cowbird, suspended from a crotch about twenty feet up in a burr-oak, composed of dried grass, cottony substances, thin pieces of bark, moss, and nearly covered with small bits of newspaper, lined with fine strips of reddish grapevine bark. The nest was in the same tree with occupied nests of a Robin and a Mourning Dove. An unusual nesting site was reported from Dallas county by J. E. Law, in a hazel bush one foot up (Iowa Orn., ii, 2, 1896, pp. 44–46).

285. (629). *Vireo solitarius* (Wils.). Blue-headed Vireo.

The Blue-headed Vireo is a regular migrant in Iowa during the first two weeks of May. In the fall it remains for a longer time, being more common during the middle of September, although I took a specimen as early as August 24, 1901, at Forest City, and Prof. C. C. Nutting took one as late as October 5, 1886, at Iowa City. W. W. Cooke estimated that in 1884 the species moved northward at the rate of more than eighty miles a day, the most rapid speed among more than a hundred species whose rate of advance was calculated. The same rapidity of migration was noted in 1885 (Bird Migr. in Miss. Val., 1884–85, pp. 235–36).

The Blue-headed Vireo is quite generally distributed over Iowa during migration, usually keeping to the heavier woods. Estimates as to its abundance are variable, it being considered tolerably common in many localities and rather rare in others. In Winnebago county the Blue-headed Vireo is quite common and

regular in migration, and I have also observed it in Johnson county. It does not nest in the state.

286. (631). *Vireo noveboracensis* (Gmel.). White-eyed Vireo.

The White-eyed Vireo is a tolerably common summer resident in southern Iowa and rather rare or irregular in the central part of the state. The most northern record in Iowa is from Sioux City, although the species has been reported from Heron Lake, Minn., May 26, 1884 (Bird Migr. in Miss. Val., 1884–85, pp. 236–37).

County records: Boone—"fairly common" (Henning). Blackhawk—"rare; nests" (Walters). Des Moines—"the bird prefers the low, dense willows and especially small trees overgrown by a dense mass of grapevines" (Bartsch, Iowa Orn., ii, 2, 1896, pp. 46–47). Jackson—"common summer resident" (Giddings). Jasper–Poweshiek—"June 1st" (Parker, Am. Nat., v, 1870, p. 168). Henry—"not common" (D. L. Savage). Johnson—A few specimens have been taken at Iowa City, but I have never observed it personally (Anderson). Lee—"common summer resident" (Currier); "scarce summer resident; breeds" (Praeger). Linn—"common summer resident" (Berry). Mahaska—"specimens taken by W. A. Bryan" (Iowa Orn., ii, 2, 1896, pp. 46–47). Poweshiek—"never found but once by me at Grinnell" (Lynds Jones). Pottawattamie—"common summer resident" (Trostler). Story—"reported by W. A. Bryan as quite common" (Iowa Orn., ii, 2, 1896, pp. 46–47). Van Buren—"common summer resident; nest with two eggs July 18, 1894, in hazel bush, eighteen inches up" (Wm. G. Savage). Woodbury—"one shot April 18, 1900" (Rich).

287. (633). *Vireo belli* Aud. Bell Vireo.

The Bell Vireo is reported from all sections of the state as a common or abundant summer resident, in some localities the commonest of the Vireos. It usually arrives in the early part of May and remains until September first. However, I have examined a specimen sent by Dr. G. C. Rich, which was shot by C. Brown at Brown's Lake, Woodbury county, October 16, 1901. The bird frequents low thickets, shrubbery and hazel bushes rather than the woods, and the nest is usually suspended in a low bush. Nests have been found in the state from the latter part of

May until August, although June is the favorite nesting time. Charles R. Keyes describes a nest placed in a small bush situated within eight feet of a railroad track over which cars were passing continually, and notwithstanding the violent swaying of the bush caused by the strong current of air created by each rapidly moving train, the young birds were successfully reared ("The Iowa Greenlets," O. & O., xii, p. 44).

The species was described and named by John James Audubon after the veteran taxidermist, J. G. Bell, who accompanied him on his Missouri River expedition in 1843. Dr. Paul Bartsch gives an Iowa reference to the species as being found in Audubon's great work on "The Birds of North America," 1844, p. 333.

Family MNIOTILTIDÆ. Wood Warblers.

The Wood Warblers are a very large family of strictly American birds. They are generally brightly colored, at least the males, and are almost wholly insectivorous. All of the species are migratory in Iowa, mostly passing north to breed, and only a few species nest in the state.

"The name 'Warbler' comes from their resemblance to the Warblers of Europe (*Sylviidæ*) and not from any distinguished musical quality of their own" (Jordan, "Manual of the Vertebrates," p. 297).

The Warblers usually appear in the spring just as the leaf buds are bursting on the trees, and their great numbers, and the assiduity with which they search out the insect life which appears in the foliage at this time, render them particularly useful and valuable allies in forest protection. The majority of the species are unknown to most people, as they are with us for only a few days in the spring and fall, and generally keep to the tree-tops.

Genus MNIOTILTA Vieillot.

288. (636). *Mniotilta varia* (Linn.). Black and White Warbler.

The Black and White Warbler is a Warbler with the habits of a Creeper or Nuthatch, generally seen nervously climbing over the trunks and larger branches of trees, but it also gleans among the smaller twigs and foliage. It is generally distributed over Iowa as a tolerably common migrant from the middle of April until the latter part of May and from about August 20 to

the latter part of September. The Black and White Warbler has been found nesting in a few restricted localities in Iowa, but it is not generally found in summer.

County records: Blackhawk—"known to breed sparingly in Linn and Blackhawk counties" (Peck). Franklin—"summer resident and migrant; fairly common" (Shoemaker). Henry—"common summer resident" (W. G. Savage). Lee—"migrant, not common; rare summer resident. June 4, 1901, nest and eggs found by myself, four miles west of Keokuk, is the only one I ever saw in that locality" (Currier). Linn—"I have seen it several times in June and July and last year saw one feeding young" (Berry). Scott—"the bulk go further north, but a few must breed here, for although I have never found a nest, I have seen both male and female birds during the summer" (Wilson). Polk—"at Des Moines has been observed in June and July and consequently may be regarded as a summer resident, but not a common one" (Keyes and Williams, Birds of Iowa, p. 151). Van Buren—"a very common summer resident of Van Buren and Henry counties. The last week in May, 1896, I found one nest on a hillside on the ground, protected by a small bush, burrowed deep down in old leaves, open at the top, but very small entrance; composed of very fine grass stems and cowtail hair" (W. G. Savage). Woodbury—"uncommon summer resident. I am ashamed to find that I made no note of the date. I noticed a pair that undoubtedly had a nest near. It was in early spring" (Rich). Winneshiek—"rare summer resident, oftenest observed in August" (Smith). In Winnebago, Hancock, and Johnson counties I have observed the species regularly, but only as migrants.

Genus PROTONOTARIA Baird.

289. (637). *Protonotaria citrea* (Bodd.). Prothonotary Warbler.

The Prothonotary Warbler is a beautiful golden-yellow species, frequenting wooded swamps and river bottoms and nesting in holes and cavities in stumps and dead trees. It is a bird of southern distribution and is only tolerably common along the bottom lands of the larger rivers in southern Iowa. It reaches to about its northern limit on the Iowa River in Johnson county, on the Cedar River in Blackhawk county (Peck), and the Des Moines River in Webster county (Somes). Dr. Trostler reports it as a

common summer resident, but becoming scarce, in Mills county, on the Missouri, while Dr. Rich reports it as rare at Sioux City. Dr. B. H. Bailey shot two males at Lansing, Allamakee county, Iowa, in 1904. The most northern record outside of the Mississippi bottoms was one male, seen alone along the Des Moines River in Kossuth county by W. H. Bingaman, May 20, 1901. The bird was not taken, but identity is positive, Mr. Bingaman having found many nests in southern Illinois.

The northward range of the Prothonotary Warbler has been greatly extended by the observations of Dr. T. S. Roberts (Auk, xvi, 1899, pp. 236–46), who found the species breeding commonly in the low heavily-timbered bottom lands bordering the Mississippi River nearly to Hastings, Minn., eighty-five miles directly north from the Iowa line. "As we advanced southward toward the Iowa line it became one of the most frequent and noticeable of the birds. They were found only in the bottomland and apparently do not pass up the heavily-wooded and deep ravines of the tributary rivers and streams." This low-lying and sheltered valley is shown to be an extensive northern prolongation of the Carolinian (Upper Austral) fauna. The vegetation also has a strong Carolinian trend. The black walnut, red mulberry, Kentucky coffee-tree, and, to a more limited extent, the shellbark hickory, find a foothold here, and the woods of Houston county are full of the May-apple (*Podophyllum peltatum*). The Louisiana Water Thrush and the Red-bellied Woodpecker were also common. Dr. Roberts noted the species nesting commonly in bird-boxes on the iron railroad bridge between La Crosse, Wis., and La Crescent, Minn. F. L. Grundtvig states: "I found it breeding in large numbers as far north as Sabula, (Jackson county, Iowa), near the Mississippi River" (Proc. Wis. Acad. Sci., Let. and Arts, x, pp. 140–41).

The species is a rare summer resident in low bottom lands of the Iowa River in Johnson county. I found a nest in a deserted Woodpecker's hole in a dead stub, about five feet from the ground, on May 30, 1904, at which time it contained two eggs; June 3, 1904, the nest contained five eggs; female sitting very close. June 25, 1905, I found a nest containing five well-feathered young birds by watching both parents carry food to the nest in a dead stump, about ten feet from the ground, just below the mouth of Turkey Creek (Johnson county).

Genus HELMINTHEROS Rafinesque.

290. (639). *Helmintheros vermivorus* (Gmel.). Worm-eating Warbler.

The Worm-eating Warbler is a rare summer resident in southern Iowa, very seldom reaching the central part of the state. I have only one record from northern Iowa, in the Des Moines Valley (Kossuth).

County records: Henry—"a set of five eggs found May 25, 1892, placed on a hillside in dense woods, composed of leaves, lined with hair-like moss and horse-hairs" (D. L. Savage, Oöl., x, 12, 1895, p. 352). Mr. Savage took another set of two eggs, with three eggs of the Cowbird, near Salem, in 1895. Kossuth—"nest with five badly incubated eggs taken June 4, 1904, in quite heavy timber on slightly sloping hillside; male taken" (Bingaman). Linn—"only one, an immature specimen, taken Aug. 2, 1889" (Berry); "spring and fall migrant, not plentiful. Collected here by M. E. Peck, spring of 1896" (Keyes). Lee—"rare migrant" (Praeger, Currier). Van Buren—"a common bird in Van Buren and Henry counties; I have found their nests in June in the thick wooded hillsides; nests on the ground, in old leaves, usually by some little brush or sprouts; very shy about the nest" (W. G. Savage).

Genus HELMINTHOPHILA Ridgway.

291. (640). *Helminthophila pinus* (Linn.). Blue-winged Warbler.

The Blue-winged Warbler is reported as a tolerably common summer resident in most localities, north as far as the central part of the state. There is only one record from northern Iowa, Dr. C. C. Smith of Decorah having seen a nest with young late in June, 1895, and observed old and young birds at other times (Winneshiek).

County records: Blackhawk—"common in migration and breeds sparingly in Linn and Blackhawk counties. Nest on the ground in masses of fallen leaves" (Peck). Decatur-Mahaska—"breeding" (Trippe, Proc. Essex Inst., xv, 1873, p. 234). Henry—"found nest June 2, 1893, on ground in clump of May-apples" (Oöl., x, 12, 1893, p. 326). Jackson—"rather rare breeder; nests in low vines and bushes" (Giddings). Johnson—Specimens in

University museum, taken at Iowa City and Tiffin (Anderson). Lee—"summer resident, common" (Currier); "rare; breeds" (Praeger). Scott—"rare migrant" (Wilson). Poweshiek—"tolerably common summer resident" (Kelsey). Pottawattamie—"common migrant; scarce summer resident" (Trostler). Linn—"summer resident" (Bailey, Berry); "not common; nest with two fresh eggs found May 22, 1896" (Keyes). Scott—"rare migrant" (Wilson). Webster—"occasional" (Somes). Van Buren—"summer resident; common; nesting on ground usually; one nest four inches from ground between four hazel bushes" (W. G. Savage).

"In Van Buren county the Blue-winged Warbler arrives about the last week in April and stays throughout the summer; has a low and not very pleasing song; sings often at noon-day when most other birds are hushed and the scorching sun is pouring forth its hottest rays" (W. S. Savage, Iowa Orn., i, 1, 1894, p. 11).

292. (642). *Helminthophila chrysoptera* (Linn.). Golden-winged Warbler.

The Golden-winged Warbler is a rather rare migrant in Iowa, and is reported as breeding in Grundy county.

County records: Blackhawk—"a regular and uncommon migrant in Blackhawk county. It is said to breed in some localities in the state, but I have never found it in any part of Iowa during the nesting season" (Peck). Grundy—"took two sets, three and four eggs, both incubated, in early June, 1898. Both nests were among the grass within four inches of the ground, in a dry willow coulée" (Bingaman). Johnson—"taken at Iowa City and elsewhere in the state" (Keyes and Williams, Birds of Iowa, p. 152); "at Iowa City the first was reported May 17, 1885" (Cooke, Bird Migr. in Miss. Val., 1884–85, pp. 240–41); two specimens in University museum were taken by C. C. Nutting and Loren Akers, May 9, 1887. Shot one male May 6, 1903, and one male May 11, 1904, at Iowa City (Anderson). Lee—"scarce migrant" (Praeger); "common migrant" (Currier). Linn—"collected here by Morton E. Peck in spring of 1896" (Keyes); "shot one female in last of June and saw one a couple of years since feeding a young Cowbird" (Berry). Mahaska—"a single specimen taken in May" (Trippe, Proc. Bost. Soc., xv, 1872, p. 234). Van Buren—"migrant, some years very abundant, while others not so plentiful;

usually appears the first of May and not staying more than ten days" (W. G. Savage). Winnebago—shot one female specimen at Forest City, August 17, 1896 (Anderson). Winneshiek—"rare; reported by Hall Thomas" (Dr. C. C. Smith).

293. (645). *Helminthophila rubricapilla* (Wils.). Nashville Warbler.

The Nashville Warbler is a tolerably common migrant in most sections of the state, arriving about the first of May and remaining until the third week in May, and in fall from the last of August until about the middle of September. The small size and inconspicuous coloration of this species allow it to escape notice unless carefully watched for. I have taken specimens on September 7 and 12, 1896; September 17, 1900; and August 30, 1901, at Forest City (Winnebago); and on May 15 and 20, 1904, at Iowa City (Johnson county). A specimen in the University museum was taken in Johnson county April 29, 1887, by Loran Akers. The species is usually observed in the tree tops in rather open woodland along streams.

294. (646). *Helminthophila celata* (Say). Orange-crowned Warbler.

The Orange-crowned Warbler is a tolerably common migrant, having been noted in the state from April 28 (Johnson) to May 28 (Winnebago) and from September 17 (Winnebago) to October 17 (Scott). Like the preceding, this species is inconspicuous and difficult to observe. Keyes and Williams state that "it frequents rather open woodland and seems to be extremely partial to the hawthorn trees" (Birds of Iowa, p. 152). The species was originally described by Thomas Say as *Sylvius celatus*, from a specimen shot at Engineers' Cantonment early in May, 1820 (Long's Exp., i, Notes, p. 334).

295. (647). *Helminthophila peregrina* (Wils.). Tennessee Warbler.

The Tennessee Warbler is a rather common migrant in all parts of Iowa. Several observers note the fact that it varies much in numbers from season to season, sometimes appearing in great abundance and other seasons it is seldom seen. It usually occurs

during the first two weeks of May, though I took one specimen as late as May 21, in Winnebago county. In fall it appears during the month of September. Morton E. Peck states that it is the noisiest of the Warblers during migration, and does not usually appear until the leaves are out. H. J. Giddings reports it as one of the most common Warblers in Jackson county, being abundant every spring, and not varying much in numbers.

Dr. I. S. Trostler reports the Tennessee Warbler as a summer resident in Mills and Pottawattamie counties, but he has no records of nesting there. The species is usually found in the tree tops during migrations, and frequently in low bushes, but seldom on the ground.

Genus COMPSOTHLYPIS Cabanis.

296. (648a). *Compsothlypis americana ramalinæ* Ridgway. Western Parula Warbler.

The Western Parula Warbler is a fairly common migrant in eastern Iowa during the first two weeks in May, but was not reported by any observers west of the middle line of the state. The only specimen that I have observed in life was a female shot out of the top of a tall tree at Forest City, Winnebago county, August 21, 1896.

F. V. Hayden noted the Parula Warbler as "very abundant in the months of May and June along the wooded bottoms of the Missouri. Its minute size and rapid flight from limb to limb among the tallest branches of the lofty cottonwoods render it a somewhat difficult bird to secure. It is most abundant on the lower Missouri below Fort Pierre" (Trans. Amer. Philos. Soc., xv, 1863, pp. 159–60).

A male specimen in the Bond collection, No. 3,636, Mus. Univ. of Iowa, taken at Tiffin (Johnson county), is typical *ramalinæ*, with broad dusky band across chest, bordered by chestnut posteriorly, and with chestnut-streaked sides. No. 8,911, male, was taken at Iowa City, April 5, 1892.

Genus DENDROICA Gray.

Subgenus PERISSOGLOSSA Baird.

297. (650). *Dendroica tigrina* (Gmel.). Cape May Warbler.

The Cape May Warbler is a species which seems to be extend-

ing its range westward. In 1878, Dr. Coues states that it was "only known west to the Mississippi" (Birds of the Colorado Valley, p. 246), but at the present time it is rather frequently observed as a migrant in Iowa during the months of May and September.

County records: Blackhawk—"this species, once considered accidental in Blackhawk county, has in recent years become comparatively common" (Peck). Jackson—"common transient" (Giddings). Johnson—"a specimen was taken at Iowa City, Nov. 27, 1886" (Keyes and Williams, Birds of Iowa, p. 153); specimen in the University museum, taken at Iowa City, May 6, 1887, and at Tiffin. Saw one male on Iowa University campus, May 10, 1905, and they were also observed by W. B. Bell on May 12, 1905 (Anderson). Linn—"spring and fall migrant" (Bailey, Berry). Poweshiek—"tolerably common transient" (Kelsey). Scott—"rather rare migrant, May 14–23; not seen in fall" (Wilson). Van Buren—"spring migrant, very rare" (W. G. Savage). Winneshiek—"rare; reported by Hall Thomas" (Smith).

The species was not reported from western Iowa. There are two definite Nebraska records,—a male taken at Alda, May 12, 1883, by F. V. Powell, and another at Omaha, May 24, 1893, by L. Skow (Rev. Birds Neb., 1904, pp. 101–102).

Subgenus DENDROICA Gray.

298. (652). *Dendroica æstiva* (Gmel.). Yellow Warbler.

The Yellow Warbler is an abundant summer resident in all parts of the state from the latter part of April or early May until September. This is the species popularly called "Wild Canary," although the American Goldfinch also shares this name. It nests commonly in willow or hazel thickets, sometimes in hedges or small groves, from two to eight feet from the ground. The nest is composed of grasses and fibrous threads and usually lined with white cottonwood down; eggs three to five, generally laid in the last week of May and first two weeks of June. The eggs of the Cowbird are frequently laid in the Yellow Warbler's nest, but if one is deposited before the rightful owner's eggs are laid, the Warbler will build a second story to the nest, imbedding the Cowbird's egg in the bottom.

299. (654). *Dendroica cærulescens* (Gmel.). Black-throated Blue Warbler.

The Black-throated Blue Warbler is a rare migrant in Iowa and was not reported from the western half of the state, although Prof. Bruner has noted it on rare occasions at West Point and Omaha, Neb. (Rev. Birds Neb., p. 102).

County records: Blackhawk—"rare transient" (Salisbury); "quite rare, though probably a regular visitor in the migrating season" (Peck). Jackson—"one of our rarest Warblers; have only noted it a few times" (Giddings). Linn—"rare migrant" (Berry); "noted in migration May 15, 1901" (Keyes). Mahaska —"noted a few times in Mahaska county" (Proc. Bost. Soc., xv, 1883, p. 235). Poweshiek—"rare transient" (Kelsey, Jones). Scott—"rare migrant, May 1–14; two seen Sept. 26, 1891, the only fall record" (Wilson). Van Buren—"shot one male in 1895, only record" (W. G. Savage). Webster—"rare" (Somes). Winnebago—Shot one male May 14, 1892, a day when warm, rainy weather brought a great wave of migrating Warblers (Anderson); "shot one in spring of 1903, at Forest City" (Halvorsen).

300. (655). *Dendroica coronata* (Linn.). Myrtle Warbler.

The Yellow Warbler or Yellow-rumped Warbler is probably the most abundant migrant Warbler in Iowa. It is the earliest to arrive in the spring, sometimes before the snow is off the ground, usually from the first to the middle of April, remaining frequently until May 20; arriving from the north from about last of September until November 1, being most abundant during October. M. E. Peck states that in migration the females usually appear several days before the males. W. W. Cooke says, "It is the hardiest of our Warblers—has been known to endure a temperature of 20° below zero without apparent inconvenience. With plenty of poison ivy berries to eat, it seems not to care how the mercury stands" (Bird Migr. in Miss. Val., 1884–85, pp. 246–48). Their winter food in the south consists largely of myrtle or bayberries, but in spring and fall they become largely insectivorous.

301. (657). *Dendroica maculosa* (Gmel.). Magnolia Warbler.

The Magnolia Warbler or Black and Yellow Warbler is a beautiful species which is a common spring and fall migrant in eastern and central Iowa. It was not reported from western Iowa, al-

though it has been rarely taken in eastern Kansas and Nebraska. It usually migrates during the second and third weeks of May and from the last week in August to the middle of September, although specimens have been taken as early as April 18 (Johnson county) and October 5 (Scott). It is a rapid migrant in spring. Cooke gives the average rate of advance through the Mississippi Valley in 1883 as thirty-five miles a day, and in 1884 as thirty-two miles. It is an active fly-catching species, usually appearing after the green leaves of the forest are out.

302. (658). *Dendroica cerulea* (Wils.). Cerulean Warbler.

The Cerulean Warbler is a tolerably common migrant and a rather rare summer resident in most parts of the state, but is seldom seen on account of its shyness and its habit of keeping to tops of the tallest trees, where the nest is placed on a horizontal limb, 20–50 feet from the ground. Dr. J. A. Allen found the species quite common at Boonesboro, 1868, where it was the only woodland *Dendroica* observed (Mem. Bost. Soc., i, 1868, p. 494). I never observed the species in Winnebago or Hancock counties, but W. H. Bingaman reports it as a rare summer resident in Kossuth county, northern Iowa.

303. (659). *Dendroica pensylvanica* (Linn.). Chestnut-sided Warbler.

The Chestnut-sided Warbler is an abundant migrant, May 1–June 1, and September 9–23, in all parts of the state, and breeds in many localities, but is rather locally distributed in summer.

County records—(breeding): Blackhawk—"breeds sparingly in Blackhawk, Linn and Tama counties" (Peck). Henry—"summer resident" (D.L.Savage). Franklin—"common summer resident" (Shoemaker). Jackson—"common migrant; rare breeder; saw a female feeding a young Cowbird, July 1, 1894" (Giddings). Lee—"abundant migrant; rare summer resident; see one or more individuals every summer near certain thickets. May 29, 1898, found a nest in a clump of Indian currents containing one egg. Another time, near the same place, saw a female building in a clump of hazel" (Currier). Linn—"fairly common summer resident" (Keyes, Berry). Mahaska—"abundant; many breed" (Trippe, Proc. Bost. Soc., xv, 1872, p. 235). Pottawattamie—"I have a set of two eggs of this species taken in Pottawattamie

county" (E. Irons, Iowa Orn., i, 1, 1894, pp. 13–14); "common migrant; scarce summer resident" (Trostler). Poweshiek—"breeds rarely" (L. Jones). Van Buren—"common summer resident, nesting two or three feet from ground, usually in a hazel thicket" (W. G. Savage). Tama—B. H. Bailey shot one specimen June 22, 1902, near Traer. Kossuth—"common summer resinent; have secured the nest and eggs several times and have three sets now in my collection, all taken in Kossuth" (Bingaman). The species is an abundant migrant in Winnebago and Hancock counties, but I have not observed it during the breeding season; shot a juvenile female August 15, 1896, at Forest City.

304. (660). *Dendroica castanea* (Wils.). Bay-breasted Warbler.

The Bay-breasted Warbler is a rather rare migrant in spring and fall in eastern Iowa, the only western Iowa record being a single specimen observed at Spencer by Paul C. Wood, April 21, 1896 (Iowa Orn., ii, 4, 1896, p. 86).

County records: Blackhawk—"rare migrant" (Salisbury, Peck); Lee (Praeger); Poweshiek (L. Jones); Johnson—May 15, on University campus (Anderson); Scott—"seen only on May 9 and 26, 1888" (Wilson); Van Buren (Wm. Savage); Winneshiek (Smith).

In Jackson county H. J. Giddings reports the Bay-breasted Warbler as "a rather common migrant. This species varies much in number in different seasons; a few times I have found it to be as common as the Chestnut-sided" (Iowa Orn., iii, 1, 1897, p. 8).

(305). (661). *Dendroica striata* (Forst.). Black-poll Warbler.

The Black-poll Warbler is a common migrant in nearly all localities reported from. It is usually the latest Warbler to migrate, arriving in southern Iowa from the first to the middle of May and sometimes tarrying in the state until the first week in June; very seldom seen in the fall. M. E. Peck says: "No other Warbler has so extreme a range of migration—its limits are the equator and the Arctic Ocean. Economically, the Black-poll is the most important of the family. It arrives just when the trees are swarming with larvæ, and its usefulness in destroying these can hardly be overestimated" (Iowa Orn., ii, 3, 1896, pp. 62–63). It has been reported once as breeding in Iowa, a nest found in Dallas county, May 20, 1894, by Mr. Fred Hamlin. The nest was ten inches from the ground in a small thorn-bush, one rod from

bank of Raccoon River; contained four eggs; female captured; male not seen" (Iowa Orn., i, 1, 1894, p. 14). During migration the Black-poll frequents the lower trees in thick woodland.

306. (662). *Dendroica blackburniæ* (Gmel.). Blackburnian Warbler.

The Orange-throated or Blackburnian Warbler is a tolerably common spring and fall migrant in eastern Iowa. It was not reported from the western part of the state, although it has been reported from Nebraska (Omaha and West Point, by Bruner), and a specimen was taken by J. J. Audubon, May 12, 1843, near Decatur, Burt county, Nebraska, a little above the mouth of the Little Sioux River (Journals, i, 485). The species appears to be somewhat irregular in numbers, some seasons being quite common, rare during others. It has been reported in Iowa from the first week of May until May 30. I have taken specimens in Winnebago county from August 17 to August 21, 1896, when they were very numerous; and also rarely in May, both in Johnson and Winnebago counties.

307. (663a). *Dendroica dominica albilora* Ridgway. Sycamore Warbler.

The Yellow-throated Warbler (*D. dominica*) was listed as an Iowa species by J. A. Allen (White's Geol. of Iowa, ii, 1870, p. 421), but it appears from the range of the two varieties that all Iowa or central Mississippi Valley records should be referred to *D. d. albilora*. The species is of southern distribution. There are three records from southern Wisconsin (Kumlien and Hollister, Birds of Wis., 1903, p. 113), and I have found only one definite Iowa record. I have examined a specimen from the collection of Mr. George H. Berry of Cedar Rapids, which he shot at Keokuk (Lee county), Iowa, May 4, 1888. It measured: Length 4.75; wing 2.69; tail 2.13; bill .50; agrees with Coues' Key and Ridgway's Manual in most particulars; superciliary stripe from base of bill to a point just anterior to eye, bright yellow, and very narrow; from a point just anterior to eye to about one-fourth inch behind eye pure white and broader (typical of *dominica*, Ridgway); "with yellow of chin cut off from bill by white" (typical of *albilora*, Coues [except at base, where there is the narrowest possible edging of white feathers]. Mr. Berry says there was

a great wave of migration on this date, and he also took the only Iowa specimen of Carolina Chickadee the same day.

308. (667). *Dendroica virens* (Gmel.). Black-throated Green Warbler.

The Black-throated Green Warbler was reported by a number of observers in the eastern and central parts of the state as a tolerably common migrant, and by a few as rare. It is a rather late migrant, B. H. Wilson giving dates of May 10–16 and September 4–23 in Scott county; in Winnebago county I have usually noted it during the latter part of May, while it has been reported as late as June 5 at Des Moines (Cooke, Bird Migr. in Miss. Val., 1884–85, p. 253). I have no records from the western part of the state, although Prof. Bruner reports the species as a rare migrant in the eastern third of Nebraska. The Black-throated Green Warbler has not been known to breed in Iowa.

309. (671). *Dendroica vigorsi* (Aud.). Pine Warbler.

The Pine Warbler is rarely found outside of pine woods, and, as a consequence, is very locally distributed in Iowa, although it frequently appears in considerable numbers during migrations.

County records: Blackhawk—"A regular but not uncommon migrant in Blackhawk county" (Peck). Dallas—"J. E. Law took one specimen Sept. 11, 1894. This species is very rare in the state and was not reported by any of the other members of the I. O. A." (Iowa Orn., i, 1, 1894, p. 17). Jackson—"very rare; shot a male April 17, 1896, and saw another April 24, the first I have ever noted here" (Giddings). Johnson—specimen in University museum, taken in spring of 1892 [May 6, 1892, E. G. Decker] (Nutting, Proc. Iowa Acad. Sci., 1892). Linn—"A specimen in collection of Geo. R. Berry was taken near Cedar Rapids April 11, 1902. He said that it was very common and that he could have taken two hundred specimens. Berry also reported that he shot a female near Cedar Rapids in July, 1903, and saw the male at same time. Scott—"In spring of 1889 a friend and myself obtained several specimens near Davenport, and, in fact, they were not uncommon for a short time" (J. H. Brown, Iowa Orn., i, 2, 1895, p. 47); "rather rare migrant, April 14–May 16; Sept. 21, 1889, my only fall record" (B. H. Wilson).

Lee—"common migrant" (Currier). Van Buren—"spring migrant; rare" (W. G. Savage).

310. (672). *Dendroica discolor* (Vieill.). Prairie Warbler.

The Prairie Warbler is not, as its name implies, a true prairie bird, but usually inhabits bushy clearings, thickets and old fields. It is a bird of the eastern United States, chiefly the middle and southern districts, and only occurs in Iowa as a rare straggler. The species has been accredited to Iowa by various authors, from W. W. Cooke (Bird Migr. in Miss. Val., 1884–85, p. 255) to R. Ridgway (Birds of N. and Mid. Amer., ii, 1902) on the strength of a specimen said to have been taken by Dr. E. H. King at West Liberty, Iowa. Through the kindness of Dr. B. H. Bailey, I examined the original mounted specimen in the Coe College collection at Cedar Rapids and found it to be a female Kentucky Warbler (*Geothlypis formosa*). The original label on bottom of stand reads, "*Dendroica discolor*, Prairie Warbler, West Liberty, Iowa, May 21, 188[1(?), last figure blurred]; L. 5.25; W. 1.75; Ts. .75; Toe .75."

Morton E. Peck writes: "I once spent several hours trying to secure one of these birds while collecting in Linn county in 1896. While I did not succeed in taking it I could not have been mistaken as to its identity, as I have observed the species in abundance in southern Missouri." G. H. Berry states that he has never seen the Prairie Warbler in Linn county, but in 1893 found both old birds and newly-fledged young in June, near Des Moines.

In Nebraska, "Bruner has noted it at West Point and Omaha, and L. Skow at the latter locality also" (Rev. Birds Neb., p. 104).

Genus SEIURUS Swainson.

312. (674.) *Seiurus aurocapillus* (Linn.). Oven-bird.

The Oven-bird is a common summer resident in all parts of the state wherever there is natural woodland. Its loud, ringing chant may be heard in almost any secluded bit of timber during the nesting season. The nest is built on the ground, usually among fallen leaves, and is neatly roofed over like an oven. The species arrives from the south about the first of May and remains until the middle of September, nesting in June. The Oven-bird is rather difficult to observe in late summer and fall, as it becomes silent and spends most of the time on the ground in dense underbrush.

313. (675a). *Seiurus noveboracensis notabilis* (Grinn.). Grinnell Water-Thrush.

The notes upon the Grinnell Water-Thrush and the eastern variety (*S. novoboracensis*) are somewhat confused in Iowa records as most observers fail to differentiate between them. *S. n. notabilis* is described as identical in coloration with the eastern Water-Thrush, but larger, length 6.00–6.25; wing 3.00–3.25; bill over .50, etc.; habitat chiefly in interior of North America, east to Illinois and western Indiana. Kumlien and Hollister state that the two varieties occur together in southeastern Wisconsin, which seems to be on the dividing line (Birds of Wis., pp. 116–17). All Iowa specimens which I have examined appear to belong to *notabilis*. The species is a tolerably common migrant in nearly all parts of the state in the first half of May and the middle of September, but has been taken as late as October 10 (Scott). It is nearly always found in damp woods, usually near ravines or watercourses, running rapidly along the ground and occaionally perching in low trees, where the peculiar see-saw or jerking movements of the tail render it somewhat conspicuous.

The Grinnell Water-Thrush is rarely found in Iowa as a summer resident. Keyes and Williams state that a female was taken in June, 1884, a few miles north of Des Moines, feeding young just from the nest (Birds of Iowa, 155). In Blackhawk county M. E. Peck gives it as an abundant migrant and quite common during the breeding season. Prof. G. W. Walters reports it as an occasional migrant and nesting in Blackhawk. H. J. Giddings gives it as a common summer resident in Jackson county and W. G. Savage as a common summer resident in Poweshiek, while Lynds Jones gave it as a tolerably common transient in the same county.

314. (676). *Seiurus motacilla* (Vieill.). Louisiana Water-Thrush.

The Louisiana Water-Thrush or Large-billed Water-Thrush or Wagtail is a species of more southern distribution, but occurs in summer along the Mississippi bottoms as far north as Red Wing, Minnesota (Roberts, Auk, xvi, 1899, pp. 239–46).

It is found in most parts of Iowa, breeding sparingly throughout its range, but is generally rare north of the middle of the state. The bird arrives from the south rather early, from the

18th to the latter part of April, and departs in September. The nest is usually concealed among the roots of a tree, on the steep banks of a ravine near a watercourse.

County records: Blackhawk—"abundant migrant; scarce summer resident" (Peck). Decatur-Mahaska—"common; some remain to breed" (Trippe, Proc. Bost. Soc., xv, 1872, p. 234). Howard—"observed at Cresco" (Webster). Johnson—Museum specimen No. 8,998, taken April 23, 1892, at Iowa City, by E. G. Decker. Kossuth—"rare breeder; two sets taken in May, 1903 and 1904" (Bingaman). Lee—"regular migrant; rarer in fall than spring; rare breeder. Currier found a nest" (Praeger); "common migrant; rare summer migrant" (Currier.) Linn—"rather common summer resident; collected set of five fresh eggs June 2, 1896" (Keyes); "rare summer resident" (Berry). Pottawattamie—"scarce summer resident" (Trostler). Polk—"one specimen taken May 22, 1885" (Bryan, Iowa Orn., i, 1, 1894, p. 15). Poweshiek—"tolerably common summer resident" (Lynds Jones). Scott—"rather rare; seen only in spring, April 26, 1890, April 25, 1891" (Wilson). Winneshiek—"common summer resident, arriving middle of April and departing in late summer; eggs laid by middle of May or earlier. The identification of these two species (Grinnell and Louisiana Water-Thrushes) was verified at National Museum" (Smith). Van Buren—"common summer resident" (W. G. Savage).

Genus GEOTHLYPIS Cabanis.

Subgenus OPORORNIS Baird.

315. (667). *Geothlypis formosa* (Wils.). Kentucky Warbler.

The Kentucky Warbler is a bird of the southern and eastern United States and is reported only in the southeastern portion of Iowa, reaching about its northern limit in Jackson and Blackhawk counties.

County records: Blackhawk—"took one specimen at La Porte City" (Peck). Des Moines—Taken at Burlington, May 11, 1884, by Dr. F. Knitham and Prof. C. J. Reed" (L. Jones, Iowa Orn., ii, 3, 1896, p. 64). Jackson—"rather rare, but a few breed here every season; nest May 19" (Giddings). Lee—"common summer resident; breeds" (Praeger); "summer resident; common, but

very local" (Currier); "rare summer resident" (Berry). Linn—female taken at West Liberty by Dr. E. H. King, on May 1, 188(1?); recorded by various writers as *D. discolor* (Anderson). Van Buren—"summer resident; common. I found a nest in the early part of June, 1894, placed in a buckberry bush about three inches above the ground and containing four young only a few days old" (W. G. Savage). Wayne—(A. J. Brown).

316. (678). *Geothlypis agilis* (Wils.). Connecticut Warbler.

The Connecticut Warbler is a rare migrant in Iowa and has only been reported by a few observers. It is probably the latest of the Warblers to migrate in the spring, having been observed migrating during the early part of June. This species has generally been considered as only a spring migrant in the Mississippi Valley and supposed to migrate southward by the Atlantic coast route. Kumlien and Hollister state, however, that they are as common in fall as in spring in Wisconsin (Birds of Wis., 1903, pp. 117–18). They are very shy, frequenting dense thickets and shrubbery during migration.

County records: Lee—"rare visitor. I have no records for the autumnal migration of either this species or *philadelphia*. It is very possible that they return by another route or pass over without a stop" (Currier). Linn—"rare and shy; one specimen taken in Linn county and one or two others observed" (Peck); "taken in spring of 1896 by Morton E. Peck" (Keyes). Van Buren—"I have taken a few specimens in Van Buren county; rare" (Wm. Savage, Iowa Orn., i, 1, 1894, p. 15); "in 1895 I shot one male. This is the only one I ever observed in our locality" Walter G. Savage). Winnebago-Hancock—Shot a male in my collection May 22, 1897 (Hancock) and female June 4, 1897, at Forest City (Winnebago). A few others were seen in dense thickets, but very shy. The species resembles *G. philadelphia* closely, but may be distinguished by the whitish orbital ring (Anderson).

Subgenus GEOTHLYPIS Cabanis.

317. (679). *Geothlypis philadelphia* (Wils.). Mourning Warbler.

The Mourning Warbler closely resembles the preceding species in appearance and habits, but is rather more common and usually migrates earlier, though it sometimes is found in company with the Connecticut Warbler. It is usually found in thickets or low

trees along streams. The bird's name is derived from the ashy veiling of the black feathers on throat and breast, which suggests the appearance of crape.

County records: Blackhawk—"migrant; late in season" (Peck). Hancock—Shot male May 22, 1897 (Anderson). Jackson—"common transient" (Giddings). Johnson—migrant; not rare; male found dead on University campus, May 29, 1903; shot male May 11, 1905 (Anderson). Linn—"taken here in spring of 1896" (Keyes); "a specimen in my collection taken June 4, 1901" (Berry); "migrant" (Bailey). Lee—"scarce migrant" (Praeger, Currier). Scott—"rare migrant; seen only in spring, May 14–22" (Wilson). Winnebago—saw one August 28, 1901, at Forest City (Anderson). Winneshiek—"rare migrant; reported by Hall Thomas" (Smith). Van Buren—"spring and fall migrant; tolerably common" (W. G. Savage).

318. (681). *Geothlypis trichas brachidactyla* (Swainson). Northern Yellow-throat.

The Iowa records of Yellow-throats have been variously referred to *G. trichas* (Maryland Yellow-throat) and *G. t. occidentalis* (Western Yellow-throat), but from the range of this new variety —"northeastern U. S. and southeastern British Provinces . . . . westward to northern Ontario, Mich., Wis., Minn., and eastern North Dakota, and southward through Mississippi Valley to upland districts of the Gulf States" (Ridgway, Birds N. and Mid. Amer., ii, p. 665)—it is apparent that all Iowa records should be referred to this subspecies. The Northern Yellow-throat is a common or abundant summer resident in all portions of the state, arriving in the early part of May and remaining until the latter part of September. While it is most common near grassy sloughs and along willow-grown creek banks, it is often seen in hedges along roadsides or gardens. The species is readily identified by its bright yellow throat and black mask along forehead and sides of cheeks. The nest is placed near the ground in clumps of grass or low bushes. On July 7, 1893, I found a nest containing two Yellow-throat's and two Cowbird's eggs, in a clump of weeds and wild willow shoots, about fifteen inches from the ground; and July 14, 1893, a slightly incubated set of three eggs in tall sawgrass in a nearly dry slough, about four inches above the ground.

Genus ICTERIA Viellot.

319. (683). *Icteria virens* (Linn.). Yellow-breasted Chat.

The Yellow-breasted Chat is the largest species of Warbler found in Iowa. It is a common summer resident as far north as the center of the state, abundant in the southeastern part, and rather rare in most localities in northern Iowa. Dr. Hatch states that the species rarely passes beyond the lower tier of counties of Minnesota (Birds of Minn., 1892, p. 400). The Chat is a noisy inhabitant of thickets and partly cleared woodland, where the nest is built in tangled bushes a few feet from the ground. Morton E. Peck states that the species was once very common in Blackhawk county, but now becoming scarce owing to the close pasturing of the woods and consequent breaking up of the favorite breeding sites. S. B. Watson notes the same condition in Des Moines county. I never observed the species in Winnebago or Hancock counties, but have a specimen in my collection taken in Cerro Gordo county by J. E. Law, May 30, 1891. W. H. Bingaman notes it as a common summer resident, nesting, in Kossuth county, while Dr. Rich reports it as an uncommon summer resident in Woodbury county.

Genus WILSONIA Bonaparte.

320. (684). *Wilsonia mitrata* (Gmel.). Hooded Warbler.

The Hooded Warbler is a southern species, of rare occurrence in southern Iowa. Its range and habits are much the same as those of the Kentucky Warbler.

County records: Blackhawk—"I have observed it once at La Porte City, which is the most northerly record of its occurrence west of the Mississippi" (Peck). Des Moines—"A single specimen taken near Burlington by Paul Bartsch, May 25, 1892" (Iowa Orn., i, 2, 1895, p. 28). Jackson—"I have only one record of this species, the first of June, the present season" (Giddings, Iowa Orn., iii, 1, 1897, p. 9). "The only specimen I have is a male, shot here in the breeding season; the female was seen at the same time" (Berry). Lee—"rare summer resident; not common, and very local" (Currier); "summer resident; breeds" (Praeger). Mahaska—"One taken in May" (Trippe, Proc. Bost. Soc., xv, 1872, p. 235). Poweshiek—"One taken May 18, 1888" (Lynds Jones). Burtis S. Wilson reports it as rare at Rock Island; one record.

Edmonde S. Currier, in an article on "The Hooded Warbler," (Iowa Orn., i, 3, 1895, pp. 67–70), describes the species as nesting commonly on low wet land near junction of Des Moines and Mississippi Rivers, in woodland of giant elms, sycamores, and locusts, with smaller undergrowth, and dense tangles of smartweed, nettles, etc. They arrive in May and depart in August, seldom wandering from the edge of their thicket. The sets are completed about the third week in June; nest usually placed in the fork of a small shrub standing in a thick growth of weeds, four to thirty inches from the ground. "I know of no other locality near here where they are so plentiful, but they are not uncommon throughout the wooded bottom-land on both sides of the Mississippi near here (Keokuk). Their haunts are almost the same as those of the Prothonotary Warbler, the Prothonotary over the water, the Hooded Warbler at its edge."

321. (685). *Wilsonia pusilla* (Wils.). Wilson Warbler.

The Wilson Warbler or Black-capped Fly-catching Warbler is a tolerably common summer migrant in the eastern and central portions of the state, occurring from the first to the latter part of May and from August 17 (Winnebago) to September 25 (Scott). It usually frequents the smaller trees in woodland, and captures many insects on the wing, like a Flycatcher. The species is recognizable by its general olive-green upper parts without wing-bars or tail-patches, yellow under parts and black crown.

322. (686). *Wilsonia canadensis* (Linn.). Canadian Warbler.

The Canadian Warbler is a tolerably common spring and fall migrant in most portions of eastern and central Iowa, although reported as rare by a few observers. It was not reported from western Iowa by any observer, although the species was noted at Engineers' Cantonment by Thomas Say in 1819–20 as *Muscipapa canadensis* (Long's Exp., i, p. 263). It has been noted in spring from May 11 (Johnson) to May 27 (Winnebago). The Canadian Warbler migrates regularly in Winnebago county from August 15 to 25 and is quite common at that time, frequenting the larger groves of native timber, actively flycatching in the tree-tops, and often also in the smaller undergrowth.

Genus SETOPHAGA Swainson.

323. (687). *Setophaga ruticilla* (Linn.). American Redstart.

The American Redstart is a common or abundant summer res-

ident in all portions of the state, being usually more numerous during the migrating seasons. It generally arrives about the first week of May, departing the second week in September. W. W. Cooke says: "This is one of the species in which the period of arrival at any locality extends over several weeks, the bulk coming many days behind the first. The bulk never arrives till a week after the first, and ten to twelve days is the ordinary time" (Bird Migr. in Miss. Val., 1884–85, pp. 262–63). The nest is usually placed from eight to twenty feet from the ground in a small tree or sapling in open woodland, neatly and compactly built, much like that of a Yellow Warbler; eggs are laid in the latter part of May or first of June. While the species occurs in most localities it is of rather local distribution, being abundant in some groves and rare in others. The species is very conspicuous in spite of its small size, as it is an active flycatcher on the wing, and from the habit of spreading the tail feathers, exposing conspicuous tail-markings, salmon-red in the male and yellow in the female.

Family MOTACILLIDÆ. Wagtails and Pipits.

This is a small family of mainly Old World species, chiefly terrestial, running upon the ground like Larks. The two species which occur in Iowa are strictly terrestrial, migratory and insectivorous, and are usually seen in flocks. They have the habit of constantly bobbing or wagging the tail, "as if they were using it to balance themselves upon unsteady footing" (Coues).

Genus ANTHUS Bechstein.

Subgenus ANTHUS Bechstein.

324. (697). *Anthus pensilvanicus* (Lath.) American Pipit.

The American Pipit is a tolerably common migrant in Iowa, usually in April and in September, in large flocks, most frequently on ploughed ground or old fields.

County records: Blackhawk—"frequent migrant" (Peck). Decatur-Mahaska—"abundant, spring and fall" (Trippe, Proc. Bost. Soc., xv, 1872, p. 234). Hancock—several seen in early spring along banks of Lime Creek (Anderson). Lee—"scarce winter visitant, Keokuk" (Praeger); "winter visitant; not common or regular" (Currier). Polk—"arrived at Des Moines April 18" (Cooke, Bird Migr. in Miss. Val., 1884–85, pp. 263–64). Win-

nebago—shot male near Forest City, April 30, 1892. Several were seen running about the bank of a small meadow pond; they were very wild and wary (Anderson). Woodbury—"rare transient" (Rich). Greene—"seen at Jefferson, September 18th to 20th, in considerable numbers, running about in loose flocks over the furrows of new breakings" (Allen, Mem. Bost. Soc., i, 1868, p. 494).

Subgenus NEOCORYS Bechstein.

325. (700). *Anthus spraguei* (Aud.). Sprague Pipit.

The Sprague Pipit is a bird of the Great Plains region but has been taken rather commonly in western Minnesota (Hatch) and as far east as Omaha, West Point and Lincoln, Neb. (Rev. Birds Neb., 1904, p. 106). The only Iowa record I have is that of Dr. I. S. Trostler, who reports it as a straggler in Pottawattamie county,—one killed near Manawa Lake, September 14, 1895.

Family MIMIDÆ. Wrens, Thrashers, Mocking Birds, etc.

This family includes about fifty species of Thrashers and Mockingbirds (*Mimina*) and about one hundred and fifty species of Wrens (*Troglodytinæ*). They are all vocalists of great ability, the former being the most accomplished musicians among our birds. They are usually plain-colored birds, gray or brown, and are chiefly insectivorous, though many species feed largely on fruits and berries. Their nests are generally placed in low bushes. The Wrens in general are smaller birds, haunting thickets, and often nesting close to the dwellings of man, usually in holes or cavities, or in bird-boxes.

Subfamily MIMINÆ. Mockingbirds, Thrashers, etc.

Genus MIMUS Boie.

326. (703). *Mimus polyglottos* (Linn.). Mockingbird.

The Mockingbird, that most renowned of American singing birds, is a rare but regular summer resident in the southern part of Iowa and there are a number of records of its occurrence in central and even in northern Iowa. The frequency of caged birds escaping from captivity renders it doubtful whether the most northern records are a normal extension of the birds' range, which is usually fixed at about 40° North.

County records: Blackhawk—"accidental" (Peck); "once in May, 1898, at Cedar Falls" (Walters). Des Moines—"even so far north as Burlington, Iowa, it was twice seen during the winter. It is possible that these last were escaped cage birds, but there was nothing in their actions to indicate it" (Cooke, Bird Migr. in Miss. Val., 1884–85, p. 265). Floyd—"A single specimen taken at Charles City" (Keyes and Williams, Birds of Iowa, p. 156). Lee—"scarce summer resident; breeds" (Praeger); "summer resident, irregular in numbers" (Currier); "rare summer resident" (Berry). Marshall—"one seen September 3, 1894, in company with about thirty Kingbirds" (Iowa Orn., i, 2, 1895, p. 52). Poweshiek-Jasper—"June 25, August 24, and October 21, in both the central counties mentioned" (H. W. Parker, Am. Nat., v, 1871, p. 168). Polk—"Have mounted one or two killed near here; very rare" (Johnson). Sioux—"I have found only one nest, in an evergreen tree in the front yard of Mr. Okey, in Hull, Iowa" (Johnson). Van Buren—"One observed in 1894" (W. G. Savage). Woodbury—"Rare summer resident. Possibly only a single bird, but was seen at several localities, all in same suburb, May 30, June 1, 1902. Was said to have been seen a year before in same neighborhood" (Rich). Wayne—"summer" (A. J. Brown). Warren—"Found just once, nesting, May 8–20, 1898" (Jeffrey). Thomas Say also observed the species (*Turdus polyglottos*) 1819–20, at Engineers' Cantonment (Long's Exp., i, p. 263).

Genus GALEOSCOPTES Cabanis.

327. (704). *Galeoscoptes carolinensis* (Linn.). Catbird.

The Catbird is a very familiar and abundant summer resident in all parts of the state, arriving from the 20th to the 30th of April and remaining until the latter part of September. B. H. Wilson reports a single specimen at Rock Island Arsenal as late as November 5, 1899, and C. K. Salisbury reports that a Catbird, probably a cripple, stayed during nearly all the winter of 1902–03 in an orchard in Blackhawk county. The eggs are generally five in number, rich greenish-blue in color, laid in the latter part of May and first part of June, although Wilson reports a set of two eggs as early as May 17 (Scott), and they are frequently found as late as July. The nests are usually placed in thickets, in gooseberry, raspberry and other bushes, or in tangled grape

arbors, from one to ten feet from the ground. Although the Catbird is known to eat fruits in garden and orchard, the large numbers of insects destroyed more than compensate for the other damage. Although, when disturbed or near the nest, the note of the Catbird is a harsh and derisive "*mew*," the true song is very melodious and pleasing.

Genus TOXOSTOMA Vieillot.

Subgenus TOXOSTOMA Vieillot.

328. (705). *Toxostoma rufum* (Linn.). Brown Thrasher.

The Brown Thrasher is an abundant summer resident in all portions of Iowa, though perhaps more abundant as a migrant in many localities. It arrives during the latter part of April and departs about the latter part of September. B. H. Wilson reports a straggler shot March 22, 1890 (Scott). The nests are usually placed in thickets, dense bushes, or brush heaps, usually not more than six or eight feet from the ground. I found one nest which was placed on the ground in an open space in a willow thicket near Lime Creek, Winnebago county. The eggs are three to six in number, usually deposited from the early part of May until July. The Brown Thrasher is an accomplished musician, usually singing from the upper branches of a tree in the morning and evening. He also frequently mocks the notes of other birds with remarkable fidelity.

Subfamily TROGLODYTINÆ. Wrens.

Genus SALPINCTES Cabanis.

329. (715). *Salpinctes obsoletus* (Say). Rock Wren.

The Rock Wren is a Western bird which has very rarely been observed in Iowa. It was first recorded from Iowa by T. Martin Trippe, who took a specimen in October, and saw several others, in Decatur county (Proc. Bost. Soc., xv, 1872, p. 236). He states: "It was seen on several occasions, far out on the prairie, running over the ties on the railroad track, retreating, when alarmed, into the dense prairie grass" (Am. Nat., 1873, p. 566). This record is also quoted by Coues, Birds of the Colo. Val., p. 161; Birds of the N. W., p. 28; Key to N. A. Birds, p. 276; Baird, Brewer, and Ridgway, Land Birds, iii, p. 503; Cooke, Bird Migr. in Miss. Val.,

p. 270; Keyes and Williams, Birds of Iowa, p. 157; Goss, Birds of Kansas, p. 606.

Dr. Guy C. Rich writes from Sioux City: "The Rock Wrens were here and bred for two or three years, but I have not seen them now for several years. A nest of eggs were discovered on June 25, 1898, badly incubated. On May 28, 1899, the birds were again seen. On June 1, 1899, I saw two and possibly three birds. They sing a great deal. Found no nest, though. I thought them to be breeding. On June 10, 1900, the birds were discovered in another deep dirt-cut along railroad; no nest found. On September 15, 1901, had a bird brought in from another locality. I have also seen the measurements of two birds shot June 22, 1898."

Genus THRYOTHORUS Vieillot.

Subgenus THRYOTHORUS Vieillot.

330. (718). *Thryothorus ludovicianus* (Lath.). Carolina Wren.

The Carolina Wren is a large Southern species which is very rare and local in Iowa, although it has been taken sporadically in Minnesota (Hatch, Birds of Minn., p. 415). Thomas Say reported the "Great Carolina Wren" at Engineers' Cantonment in 1819–20 (Long's Exp., i, p. 264) and the species was listed by J. A. Allen in 1870.

County records: Lee—"resident; not common and very local" (Currier). Linn—"rare summer resident" (Berry). Van Buren—"about fifteen years ago two were observed, three years later three were observed, and in 1896 two were seen" (W. G. Savage). Webster—"few" (Somes). Chapman (Birds E. N. A.) and Ridgway (Birds N. and Mid. Am.) give the Carolina Wren as ranging north to southern Iowa.

Genus THRYOMANES Sclater.

331. (719). *Thryomanes bewicki* (Aud.). Bewick Wren.

The Bewick Wren is also rare and very locally distributed in Iowa, although it has been known to occur in southern Minnesota (Trippe, Proc. Essex Inst., vi, 1871, p. 115; Hatch, Birds of Minn., p. 416; Cooke, Bird Migr., p. 271).

County records: Des Moines—"A specimen taken by Paul Bartsch at Burlington, April 10, 1893, reported by C. C. Nutting

(Proc. Iowa Acad. Sci., 1894, p. 44). "The fourth in order of abundance; a rather uncertain summer resident; for some years he will fail to put in an appearance and the next he may be quite abundant . . . seeks the habitation of man. Two nests within the city limits—May 25, 1892, and May 30, 1893" (Paul Bartsch, "The Wrens of Burlington, Iowa," Iowa Orn., iii, 2, 1897, p. 23). Jackson—"rare transient. The last record I have is a single bird seen April 6, 1890, one seen again next day, and several on April 8, 1890" (Giddings). Lee—"scarce summer resident; breeds" (Praeger); "summer resident; not common" (Currier). Linn—"One specimen seen in May, 1903" (Berry). Van Buren—"summer resident; tolerably common" (W. G. Savage). Webster—"rare; one specimen" (Somes).

Genus TROGLODYTES Vieillot.

Subgenus TROGLODYTES Viellot.

332. (721). *Troglodytes aëdon parkmani* (Aud.). Western House Wren.

The Western House Wren is an abundant summer resident in all portions of the state from about the middle of April until October. Late fall records are apt to be confused with the Winter Wren, which it resembles very much. There has been much confusion as to the status of the House Wrens of the upper Mississippi Valley, they having been referred both to the eastern form *T. aëdon* and the western form of *T. a. aztecus* (= *T. a. parkmani*). Dr. T. S. Roberts (Geol. and Nat. Hist. Minn., 1880, p. 157) reports that R. Ridgway pronounced a series from different localities in the state to be all typical *parkmani*. In eastern and southern Wisconsin Mr. Wm. Brewster finds typical examples of both forms, *aëdon* and *aztecus*, the latter slightly predominating in numbers (Kumlien and Hollister, Birds of Wis., p. 122). Robert Ridgway states: "*T. a. aëdon* has come from the east or northeast and *T. a. parkmani* from the west or northwest until they have practically met (or perhaps by the present time overlapped) in the lower Wabash Valley . . . previous to about 1870 *Thryomanes bewicki* having been the only 'house wren' of that region" (Birds of N. and Mid. Am., iii, 1904, p. 583).

The Western House Wren in Iowa is a very tame and familiar

bird, nesting anywhere about houses, in bird-boxes, or under the thatched roofs of straw sheds, in outbuildings, or in deserted Woodpeckers' holes in the woods. The nest is very large and bulky, the Wren seeming determined to carry in enough twigs to fill the nesting cavity, no matter what its size. Two or three broods are reared in a season. The House Wren is an exceedingly energetic songster throughout the summer.

Genus OLBIORCHILUS Oberholser.

333. (722). *Olbiorchilus hiemalis* (Vieill.). Winter Wren.

The Winter Wren is a rather rare migrant but occurs in most portions of the state, most commonly in April and October. It was reported as a common winter resident in Lee county by Currier and rare in winter by Praeger, but an abundant migrant; as a rare winter visitant in Pottawattamie (Trostler), and a rather uncommon but regular winter resident upon the bluffs of the Mississippi at Burlington (Bartsch, Iowa Orn., iii, 2, 1897, p. 23). The Winter Wren is much shyer than the common House Wren and usually is found in old wood and brush heaps and thick shrubbery and brambles along ravines and creeks. B. H. Wilson observed the species in Scott county but four times in spring during five years' observation; from April 13 to 30; more common in fall; observed from September 21 to November 8. In Winnebago county I only observed one specimen during several years' collecting, taking a female specimen April 17, 1897; M. E. Halvorsen, however, reports a specimen observed at Forest City in December, 1903. It is doubtful whether the Winter Wren breeds in Iowa at the present time, although W. W. Cooke states that "Mr. Preston has found it as a not common breeder in central Iowa" (Bird Migr. in Miss. Val., 1884–85, pp. 178–79).

Genus CISTOTHORUS Cabanis.

Subgenus CISTOTHOROUS Cabanis.

334. (724). *Cistothorous stellaris* (Licht.). Short-billed Marsh Wren.

The Short-billed Marsh Wren is a tolerably common migrant in all parts of the state and a summer resident in favorable localities from the latter part of April until the latter part of October. It is much less common than the Long-billed Marsh Wren, and as a

rule frequents dryer situations, wet meadows, and the borders of swamps and marshes, where the nest is hung quite close to the ground in meadow grass. The eggs are 5–7 in number and pure white. The Short-billed Marsh Wren is rather difficult to observe, as it is shyer than the other species and slinks away through the grass and reeds with great secretiveness.

Genus TELMATODYTES Cabanis.

335. (725). *Telmatodytes palustris iliacus* Ridgway. Prairie Marsh Wren.

The Long-billed Marsh Wren, or rather its new subspecies, the Prairie Marsh Wren of Ridgway, is a common summer resident in all parts of the state where suitable sloughs and marshes may be found, being even abundant in some marshes, where its "rippling, bubbling, gurgling song" may be heard as the little performer clings to the stem of a swaying reed. The song is often heard at night, having the effect of a tiny bell tinkling in the darkness. Several pairs are often found breeding in the same marsh, and in such places dozens of the large globular nests may be easily found, made of plaited rushes and saw-grass, with a tiny hole in the side, suspended in reeds, rushes or saw-grass, about a foot above the water. There will usually be at least half a dozen of these conspicuous, new, unlined nests to each pair of birds, but whether they are built as "decoys," for the residence of the male birds, or as an expression of superabundant home-making energy, is not known. The true nest which contains the eggs is invariably a more dilapidated affair, more securely hidden, and nearer the ground or water's edge. The eggs number four to seven, very dark-colored, so thickly dotted with chocolate-brown as to appear almost unicolored, the brown frequently forming a dark wreath around the larger end. In Hancock county I found several nests containing from one to seven fresh or very slightly incubated eggs on June 12, 1897.

The Prairie Marsh Wren appears in Iowa from the middle of of April to the first of May, and departs in September. In many parts of the state both species of Marsh Wrens are growing much scarcer from year to year, owing to the restriction of their breeding grounds by the extensive draining of sloughs and tiling of meadows.

Family CERTHIDÆ. Creepers.

This is an Old World family of about twelve species, of which only one species with several varieties is found in America. They creep upon the bark of trees, using the stiffened tail feathers as a prop in climbing, like the Woodpeckers. The Creepers are of great service in destroying insects which lurk in the crevices of bark.

Genus CERTHIA Linnæus.

336. (726). *Certhia familiaris americana* (Bonaparte). Brown Creeper.

The Brown Creeper is abundant as a migrant and tolerably common as a winter resident in nearly all portions of the state, although it is rather rare and irregular in winter in the northern parts of Iowa. It is usually found from the latter part of September until the last of April, and very rarely remains during the summer. The only authentic record of its nesting in Iowa was reported by Burtis R. Wilson (Oölogist, x, 9, 1893, p. 260). He found a nest containing three newly-hatched young on an island in the Mississippi River five miles below Davenport, May 10, 1891; nest fifteen feet up, behind a loose strip of bark hanging to the side of a large dead willow stub. Both birds were seen to visit the nest with food for the young. A. I. Johnson reports the Brown Creeper as a summer resident, nesting, in Polk county; Dr. G. C. Rich reports it as a rare resident in Woodbury county; and Dr. I. S. Trostler as a scarce resident in Pottawattamie and Mills counties. "Trostler has evidence of its breeding near Omaha, rarely" (Rev. Birds Neb., p. 110).

The Creeper pays little attention to observers, creeping up in spirals around a tree-trunk, then dropping to the foot of another tree, occasionally uttering a few squeaky notes.

Family SITTIDÆ. Nuthatches.

The Nuthatches are represented by two species in Iowa, one resident and one migratory. They are the most agile of Creepers, clinging to the tree-trunks and larger branches in every imaginable position, with the head downward as readily as upward. They cling to the bark by the feet alone, deriving no support from the tail. They are chiefly insectivorous, but acorns, beechnuts, etc., are occasionally opened.

Genus SITTA Linnæus.

337. (727). *Sitta carolinensis* Lath. White-breasted Nuthatch.

The White-breasted Nuthatch is a common resident throughout the year in all parts of Iowa. It is perhaps more commonly noticed in winter, when it is frequently seen creeping over tree-trunks in door-yards, uttering a peculiar nasal *quank*, *quank*, as it peers into crevices in the bark. The species nests rather early, usually in the latter part of April or first of May, in a natural or ex cavated cavity in a tree, at some distance from the ground. Keyes and Williams (Birds of Iowa, p. 158) record taking a set of five eggs April 15, 1880, from a cavity thirty feet from the ground in a large white-oak. The nest was visited quite frequently for the next two or three weeks—until fifteen eggs had been taken out.

338. (728). *Sitta canadensis* Linn. Red-breasted Nuthatch.

The Red-breasted Nuthatch is reported as a rather rare and somewhat irregular migrant in most portions of Iowa, and only reported as tolerably common by Peck (Blackhawk), Kelsey (Poweshiek), Johnson (Polk), Keyes (Linn), and Giddings (Jackson). They are more commonly observed in fall, recorded from September 21 to October 23 (Scott), October 13–31 (Linn), and I have taken one specimen as early as August 30 (Winnebago), though the species is most common in September. Wilson reported it in spring from May 1 to 10 (Scott). The Red-breasted Nuthatch was reported in summer from Polo, in northern Illinois, and at Newton, in central Iowa, it was recorded as a resident (Cooke, Bird Migr. in Miss. Val., 1884–85, p. 276). Dr. C. Hart Merrian is of the opinion that these summer records need verification.

Family PARIDÆ. Titmice or Chicadees.

The Titmice are, superficially, very much like miniature Jays in appearance, but are all small birds, hardy, and very slightly migratory. They are somewhat gregarious after the breeding season and wander through the woods in scattering groups, exploring branches, twigs, crevices of bark, leaf-buds, and in winter picking at fruit which still hangs on the branches.

Subfamily PARINÆ. True Titmice.

Genus BÆLOPHUS Cabanis.

339. (731). *Bælophus bicolor* (Linn.). Tufted Titmouse.

The Tufted Titmouse is a rather rare resident in southern Iowa, seldom reaching the northern part of the state, although it has been occasionally taken in the extreme southern counties of Minnesota.

County records: Blackhawk—"Have seen persons who have collected them occasionally in the vicinity of Cedar Falls, Iowa" (Hatch, Birds of Minn., 1892, p. 427); "accidental" (Peck); "one specimen in May, 1900; in I. S. N. S. museum" (Walters). Decatur-Mahaska—"resident throughout the year; abundant" (Trippe, Proc. Bost. Soc., xv, 1873, p. 236). Johnson—Two specimens in Bond collection, taken at Iowa City. Delaware—"not common; seen only in woods" (Rann). Lee—"common resident; breeds" (Currier, Praeger). Linn—"spring migrant" (Bailey); "rare summer resident" (Berry). Poweshiek—"I found it once, October 14, 1886, and this is the only Grinnell record" (L. Jones). Van Buren—"rare resident" (W. G. Savage). Warren—"resident; common in certain localities" (Jeffrey). "Tabor, Iowa, noticed rarely in winter" (J. E. Todd, Am. Nat., xiv, 1880, p. 602).

Genus PARUS Linnæus.

Subgenus PARUS Linnæus.

340. (735). *Parus atricapillus* Linn. Chickadee.

The Black-capped Chickadee is reported as a familiar and abundant resident throughout the state, although in the western parts of the state it is largely replaced by the Long-tailed Chickadee. The two forms are so much alike that, without more material at hand, it is impossible to limit the ranges of the two in the state. "In extreme eastern Nebraska an occasional Chickadee is found nearer to *atricapillus* than the following form, but such are not plentiful, and most of the eastern Nebraska birds are intermediate" (Rev. Birds Neb., p. 112). During winter months the Chickadees come regularly into towns in search of food, but in spring and summer they retire to woodlands. The nest is excavated in a decayed post or dead stub, usually only a few feet from the ground, and six or seven eggs are laid the last of April or first

of May, but I have found young birds in the nest early in July, in Winnebago, so two broods are probably reared. The usual note of the bird is the familiar *chick-a-dee*, but in the springtime they frequently utter a clearly-whistled *pee-we-o* note, much like the Phœbe's note.

341. (735a). *Parus atricapillus septentrionalis* (Harris). Long-tailed Chickadee.

This is a Western form, best developed in the upper Missouri and Rocky Mountain region, averaging larger, with tail longer, rather exceeding wing in length, and wings and tail more conspicuously white-edged; average measurements: length 5.25–5.50; wings 2.50–2.75; tail 2.60–2.80. This is probably the common form in western Iowa, the most eastern record in the state being a specimen in my collection taken at Iowa City, Johnson county, (identified by Robert Ridgway).

County records: Fremont—"nesting" (Norris H. Reed, Oöl., vii, 9, 1890, p. 142). Johnson—Shot one male at Iowa City, December 30, 1899 (Anderson). Mitchell-Winnebago—"breeding" (Ridgway, Birds N. and Mid. Amer., iii, p. 400). Pottawattamie and Mills—"common resident; breeds" (Trostler). Polk—"common resident; nests. I have no specimens now. They are a trifle larger than the common form [which also occurs in Polk county] and have a longer tail. I looked them up at the time and they corresponded to the description given by Coues" (Johnson). Sioux—"summer resident; shot a pair near Hawarden, in 1890, which I think were this form; they had all the earmarks, anyway" (Berry). Woodbury—R. Ridgway identified four specimens, Mus. Nos. 17,609–11–12–18, all taken at Sioux City, in December, as *septentrionalis*. Eleven other specimens taken at Sioux City in December average about the same in measurements (Anderson).

342. (736). *Parus carolinensis* Aud. Carolina Chickadee.

The only Iowa record of this small Southern species is a specimen which I have examined, from the collection of Geo. H. Berry of Cedar Rapids. He shot the bird at Keokuk, Iowa, May 4, 1888. It measures: L. 4; W. 2.38; T. 2.06. The specimen in general appears very much smaller than the common Chickadee, quills, tertials and rectrices with very indistinct whitish edgings,

almost obliterated on tail; in all respects typical *carolinensis* as described by Coues, Ridgway, and Baird, Brewer and Ridgway. A specimen of the Sycamore Warbler (another Southern form) was taken by Mr. Berry the same day—probably carried north by the same migration wave.

Family SYLVIIDÆ. Warblers, Kinglets, and Gnatcatchers.

This family comprises the Old World true Warblers, the Kinglets, of which two species are found in Iowa, and the Gnatcatchers, of which we have one species. They are active, restless little birds, and are almost strictly insectivorous. They are quite melodious songsters, although the Kinglets rarely sing before they reach their summer homes, and the Gnatcatcher's notes are rather weak.

Subfamily REGULINÆ. Kinglets.

Genus REGULUS Cuvier.

343. (748). *Regulus satrapa* Licht. Golden-crowned Kinglet.

The Golden-crowned Kinglet is a common migrant in all parts of the state, rather common as a winter visitant in southern Iowa, and irregularly and rarely found in winter in northern Iowa. I shot a specimen at Forest City (Winnebago), December 31, 1891, and Dr. C. C. Smith has observed it in February and April in Winneshiek. The species usually arrives from the south about April 1st and is common until the 15th, (recorded March 24–May 7 in Scott county), and in fall is most abundant in October (recorded September 19–December 1 in Scott county). The Golden-crowned Kinglets are generally seen flitting about the terminal branches of low trees, frequently in willows along water-courses, but they are also common in larger timber.

344. (749). *Regulus calendula* (Linn.). Ruby-crowned Kinglet.

The Ruby-crowned Kinglet is an abundant migrant in all parts of the state, being in general more common than the Golden-crowned Kinglet, the bulk arriving later in the spring and earlier in the fall. B. H. Wilson has noted the species from April 4 to May 20 and from September 18 to October 26 (Scott). The species is not very often observed in winter, the only record being that of Dr. Trostler, who reports it as an irregular winter visitant

in Pottawattamie and Mills counties. Chas. R. Keyes writes that "in 1903 they were plentiful from October 1 to October 15, and a single bird remained about the house until November 26 at least. A number of times I noticed the species singing the first half of its song" (Mt. Vernon, Linn county). Like the Golden-crowned Kinglet, this species gathers most of its food from leaf and twig, but also catches insects on the wing.

Subfamily POLIOPTILINÆ. Gnatcatchers.

Genus POLIOPTILA Sclater.

345. (751). *Polioptila cærulea* (Linn.). Blue-gray Gnatcatcher.

The Blue-gray Gnatcatcher is a common summer resident in the southern part of Iowa from the latter part of April until the latter part of September. While the species occurs quite regularly in summer as far north as the central part of the state, it very seldom reaches northern Iowa. The bird frequents woodland, keeping in the tops of the higher trees, where the nest is placed on a horizontal limb—a beautiful, deeply-cupped, lichen-covered structure, like the nest of a hummingbird, but larger. David L. Savage describes the nesting habits of the Blue-gray Gnatcatcher in Henry county (Nidologist, i, 9, pp. 137–38), where he has found many nests; sometimes placed in the very top of the tallest trees, fifty feet from the ground, and at other times no more than ten feet, but more often fifteen or twenty feet from the ground. The nest nearly always contains one or more eggs of the Cowbird.

County records: Blackhawk—"frequent breeder in Blackhawk county, which seems to be near their northern limit" (Peck). Decatur-Mahaska (Trippe). Henry (Savage). Johnson (Akers and others). Delaware (Rann). Lee (Currier, Praeger). Linn (Keyes, Bailey, Berry). Muscatine (Wilson). Poweshiek (Kelsey, Jones). Pottawattamie (Trostler). Polk (Cooke). Scott (Wilson). Van Buren (W. G. Savage). Warren (Jeffrey).

Family TURDIDÆ. Thrushes, Bluebirds, etc.

The Thrushes form a rather large and not very distinctly defined family, including about twelve species, with many varieties, inhabiting the United States. About eight varieties are known to occur in Iowa. They are birds with rather long, not conical,

bill, rictus bristled, and nostrils not concealed. The tarsus is always "booted," i. e., the scutella fused together. They are all songsters of great sweetness and power, and are placed by most ornithologists as the highest type of bird in structure and organization. They feed upon insects and soft fruits.

Subfamily TURDINÆ. Thrushes, Bluebirds.

Genus HYLOCICHLA Baird.

346. (755). *Hylocichla mustelina* (Gmel.). Wood Thrush.

The Wood Thrush is a common or abundant summer resident in all parts of Iowa from the early part of May until September. While it is most common in thick, shady woods, the Wood Thrush frequently appears on shaded lawns. It is a beautiful songster, with tones of a mellow, flute-like quality. The species is recognized at sight by the bright cinnamon upper parts and conspicuously spotted breast and sides. The nest is a substantial structure of leaves, rootlets and weeds, well plastered with mud and lined with fine rootlets; usually placed in a small tree from six to fifteen feet from the ground, rarely as high as thirty feet. The Wood Thrush is frequently imposed upon by the Cowbird, Keyes and Williams noting instances in which the Thrush was sitting on eggs of the Cowbird, with none of its own, and another nest contained four eggs of each species—eight in all. The eggs are three to five in number and plain greenish-blue in color.

347. (756). *Hylocichla fuscescens* (Steph.). Wilson Thrush.

The Wilson Thrush or Tawny Thrush is a tolerably common migrant in eastern and central Iowa and very rare in the western part of the state. "In his notes on the Birds of Iowa, Allen reports *T. fuscescens* as being very common in western Iowa [July, Mem. Bost. Soc., i, 1868, p. 493], but in the course of two years' careful observation in the southern part of the state (Decatur and Mahaska counties) I have never seen or heard a single individual of this species" (T. M. Trippe, Proc. Bost. Soc., xv, 1872, p. 234). The Wilson Thrush occurs very rarely as a summer resident from central Iowa northward, frequenting low, damp woods and thickets, and is very shy and retiring in its habits. Keyes and Williams state that several nests have been taken at Des Moines which are thought to belong to this species (Birds of Iowa, 1889,

p. 160). Carl Kelsey reported it as a tolerably common summer resident in Poweshiek county and W. H. Bingaman writes that he has found one nest, containing four fresh eggs, May 30, 1903, on the ground in a swampy place along King Creek in Kossuth county. I have observed the species on very rare occasions in Winnebago county, in summer, but have found no nests, although the species occurs quite commonly during migration. B. H. Wilson reports the species as a "rare migrant; one shot June 9, 1889, and another May 14, 1892" (Scott).

348. (757). *Hylocichla aliciæ* (Baird). Gray-cheeked Thrush.

The Gray-cheeked Thrush is a tolerably common migrant in most parts of the state, usually during the first three weeks of May, but it has been observed as early as April 24 and as late as May 30 (Scott). The bird is usually observed in open woods, frequenting low trees and shrubs. The species resemble the Olive-backed Thrush very closely, but may be known from it by having *no buff ring around eye.*

County records: Franklin—"migrant, not common" (Shoemaker. Jackson—"tolerably common migrant" (Giddings). Johnson—common migrant; shot specimens May 11 and May 15, 1905, at Iowa City—identified by Robert Ridgway (Anderson); Mus. No. 3,650, Bond collection, Tiffin, Iowa. Lee—"rare migrant; only record May 13, 1888" (Praeger); "common migrant" (Currier). Polk—"first seen at Des Moines May 8, where it remained only three days" (Cooke, Bird Migr. in Miss. Val., 1884–85, p. 285). Poweshiek—"tolerably common transient" (Kelsey). Scott—"abundant migrant in spring, April 24 to May 30; September 20, 1889, is my only fall record" (Wilson). Sioux—"shot bird at Hawarden in 1890" (Berry). Winneshiek—"only record, one bird shot in May, 1896" (Smith). F. V. Hayden records the species "as most abundant along the wooded bottoms of the Mississippi and the lower Missouri; not observed above the mouth of the Niobrara river on the Missouri" (Trans. Am. Philos. Soc., xii, 1863, p. 159).

349. (758a). *Hylocichla ustulata swainson* (Cab.). Olive-backed Thrush.

The Olive-backed Thrush is a tolerably common migrant in all parts of the state and is even abundant at times. The usual time

of migration is during the first three weeks of May and the last three weeks of September, at which time the birds are not confined to the woods but are also found in underbrush, along hedgerows and roadsides, spending most of the time on the ground in company with Sparrows and other migrants. B. H. Wilson has noted the species from April 24 to May 27 and from September 21 to October 17, in Scott county. I shot one specimen September 7, 1896, at Forest City, (identified by R. Ridgway); a number were seen at the same time. The species is a very common migrant at Iowa City. The Olive-backed Thrush has not been known to breed in the state, although Dr. I. S. Trostler reports it as a rare summer resident in Mills and Pottawattamie counties.

350. (759b). *Hylocichla aonalaschkæ pallasi* (Cabanis). Hermit Thrush.

The Hermit Thrush is a rather common migrant in eastern and central Iowa, but rare in the western part of the state. It arrives the earliest in the spring and departs the latest in the fall of any of our Thrushes. B. H. Wilson has noted the species from April 4 to May 4 and from September 20 to October 5, in Scott county. It appears most abundantly in central Iowa about April 10. It is a quiet, sombre-colored bird, and is rather retiring, staying most of the time in thickets, where it spends much time on the ground, flying at short intervals to some horizontal limb where it will frequently remain, perfectly motionless, for some time. None of the recent observers report the Hermit Thrush in summer, but W. W. Cooke states: "comparatively few instances have been recorded of the breeding of the Hermit Thrush within the Mississippi Valley. At Grinnell, Iowa, the nest was found and identified with the bird upon it. The nest and eggs are now in the Iowa College at Grinnell. At Des Moines they have been seen in the breeding season, but no nest has been found" (Bird Migr. in Miss. Val., 1884–85, p. 286).

Genus MERULA Leach.

351. (761). *Merula migratoria* (Linn.). American Robin.

The Robin is probably the most familiar and best known of our native birds. It is an abundant summer resident in all parts of the state, nesting commonly in shade trees and groves about

houses. The Robin is an early migrant, usually arriving about the first week in March, though often appearing in February and remaining until the first of November. A few individuals frequently remain throughout the winter. Thomas Say states that they "arrived April 11, 1820, at Engineers' Cantonment" (Long's Exp., i).

J. E. Todd (Am. Nat., xiv, 1880, p. 601–2) states: "In western Iowa, at about the same latitude (of Evanston, Ill.) robins remain in wooded valleys throughout the winter. Last December I observed them in flocks in the underbrush along the Missouri River, opposite Plattsmouth, Neb. On the uplands, which are about three hundred feet higher and more open, they are not so frequently seen during the winter months."

Chas. Aldrich noted Robins at Webster City in January and February, 1881 (Am. Nat., xv, 1881, p. 477); and they were observed at Muscatine, January 1 and 5, 1881, when the ground was covered with snow and the thermometer down to zero (O. & O., vi, 1, 1881, p. 7). Two were taken at Des Moines Nov. 25, 1895, by A. I. Johnson (Iowa Orn., ii, 2, 1896, p. 50). In Lee county it was reported frequent in winter (Praeger, Currier); in Linn county a few occasionally spend the winter in protected places (Keyes), and sometimes remain in Boone county all winter (Henning). In Winnebago county I shot a male from a flock of five or six, Feb. 14, 1891, which is my earliest record for that locality. The Robins are gregarious in fall, winter and early spring; sometimes a flock will number hundreds in October.

The first set of eggs are laid about the middle of April and I have found fresh eggs as late as July 14, at Forest City. Two broods are generally reared. In summer the Robin generally consumes a considerable quantity of berries and other small fruits, but the immense quantities of worms and grubs which are destroyed in the spring, and other insects in late summer, much more than compensate for the damages inflicted.

The Robin has unquestionably increased in numbers since the settlement of the state. Audubon noted that Robins were very scarce near Council Bluffs May 10, 1843 (Journals, i, p. 481). In 1868, J. A. Allen states that they were "nowhere very common. Seen chiefly along the skirts of the timber, in which it is forced to breed, the prairies being, of course, naturally treeless, and the

county too recently settled to possess orchards. West of Boonesboro, during a period of over two months, I saw not more than fifty individuals altogether. Said to be pretty common in spring" (Mem. Bost. Soc., xv, 1868, p. 493).

In Decatur and Mahaska counties, T. M. Trippe states: "Not as familiar as the Robin of the East. In spring and fall it is more abundant than in summer, though many remain to breed. Not seen in winter." (Proc. Bost. Soc., xv, 1872, p. 234).

W. W. Searles of Lime Springs, Iowa, records: "Two years ago an albino Robin built its nest just about four rods from my gallery door. He was not all white, but marked like the Belted Kingfisher" (Iowa Orn, i, 4, 1893, p. 90). I shot a specimen October 30, 1896, near Forest City, which had large white-blotched areas in the plumage, particularly about the head.

Genus SIALIA Swainson.

352. (766). *Sialia sialis* (Linn.). Bluebird.

The Bluebird is a common summer resident in all parts of the state from about the first of March until the first of November. Its gentle, mellow notes are among the surest and most welcome signs of spring. In the winter of 1893-1894 the Bluebirds were almost exterminated by the severe weather which prevailed in the South during that season, and for two or three years the species was only seen very rarely in Iowa. The numbers have been increasing every year, until now the Bluebirds have almost regained their former numbers. They formerly nested very commonly in bird-boxes, cornices of houses, or even tin cans nailed up, but the English Sparrows have nearly driven them from the towns. The nests are usually placed in deserted holes of the Woodpecker, and the four or five pale-blue eggs are laid about the middle or last of April. The eggs of the Bluebird are occasionally pure white; so-called "albino sets" have been reported by G. H. Berry at Cedar Rapids (O. & O., xviii, 1893, p. 99) and by D. F. Hall at Creston (Oölogist, xii, 8, 1895, pp. 131-2). Mr. Hall noted a pair about May 1 carrying nest material into a deserted Woodpecker's excavation, in which they reared one brood in safety. A second nest was built in an old paint bucket hung on the broken limb of a crab-apple tree, and the eggs, which were pure white, deposited June 13th, 14th, 15th,

17th and 19th. A new nest was built in another paint pail about eighteen inches from the first, the first egg, also white, being laid June 29th; set of four eggs taken July 5th; after which the old birds did not build again but joined the first brood and remained in the neighborhood about two weeks.

On July 10, 1893, I took a set of three white eggs from a nest in a cavity in a fence post by the side of a much travelled road near Forest City, Iowa. The birds showed no appreciable difference from ordinary Bluebirds.

353. (767a). *Sialia mexicana bairdi* Ridgway. Chestnut-backed Bluebird.

This is a bird of the West and only occurs very rarely as a straggler in Iowa. It has been reported from Iowa as the Western Bluebird (*Sialia mexicana*), by various authorities. Baird Brewer and Ridgway state that the species has been observed in western Iowa by Mr. Atkinson (Birds of N. A., Land Birds, iii, 1875, p. 501). Dr. Elliott Coues states: "The Western Bluebird apparently inhabits only a limited area in the southwestern part of the Missouri region. Mr. Ridgway informs me of its occurrence in Iowa, but this must be highly exceptional" (Birds of the N. W., 1874, p. 14). "Stragglers have been recorded from Minnesota and Iowa" (Cooke, Bird Migr. in Miss. Val., p. 294). "Occasionally taken in western Iowa" (Keyes and Williams, p. 161). The Chestnut-backed Bluebird is included in the Nebraska list on Aughey's record, about seven miles from the mouth of the Niobrara River in August . . . "accidental east to Iowa and Minnesota . . . occurring regularly as a migrant along the eastern base of the Rockies" (Rev. Bds. Neb., p. 115).

George H. Berry writes: "In the spring of 1903, I saw one bird near Cedar Rapids with a flock of typical *sialis* that had a blue breast instead of the usual brownish chestnut. Had a good long look at it."

INTRODUCED SPECIES.

Order PASSERES.

Family FRINGILLIDÆ.

Subfamily PASSERINÆ.

Genus PASSER Brisson.

Passer domesticus (Linn.). European House Sparrow.

The European House Sparrow or English Sparrow is the most abundant bird in Iowa, resident throughout the year, and equally abundant in city and in country. In 1884-85 W. W. Cooke reported the English Sparrow as absent from the northwestern corner of Iowa.

Walter B. Barrows, in his book on "The English Sparrow in North America" (U. S. Dept. Agri., Div. Econ. Orn. and Mam., Bulletin 1, 1889), traces the history of its introduction and spread in North America. It was first introduced into the United States at Brooklyn, N. Y., in 1851 and 1852. Specimens were introduced directly from Europe, at Iowa City, in 1881; at Cedar Rapids they were introduced from Massachusetts, about 1874; Davenport, 1870, ten pairs; Dubuque, 1876, twenty pairs. They appeared at Burlington in 1869-70, and may have been introduced, although not so reported. In the autumn of 1886 the Sparrow was reported present at 59 places in Iowa, mostly in the eastern part of the state, and not present at 142 places, mostly in the western part of the state, but some in eastern Iowa. At first they remained closely in towns and cities and only spread into the surrounding country when the city became too crowded, probably due largely to lack of nesting places for all. The injury caused by Sparrows may be summed up:—filthiness about houses and granaries; injury to grain, fruits, garden vegetables; destruction of fruit-buds and blossoms; and, most important of all, driv- away the native birds from the haunts of man. They have failed in the chief reason of their introduction—the destruction of insect pests, the insects which they do eat are those which are acceptable to other birds, and many other injurious insects, such as

hairy caterpillars, they never touch. The nests are placed anywhere about buildings and sheds, sometimes in trees and vines, and as several broods are raised in a season their increase in numbers is exceedingly rapid.

"At the present time (1899) it is found in every state and territory except Alaska, Arizona, Montana and Nevada" (Palmer); (F. M. Bailey, Handbook Bds. Wn. N. A., p. 324).

HYPOTHETICAL LIST.

The species included in this list are those which have been taken in adjoining states, very close to the borders of Iowa, and such as may at any time be expected to occur within the limits of the state. A few species, which have heretofore been reported as occurring in Iowa upon what appears to be insufficient evidence, are also relegated to this list.

Family LARIDÆ. Gulls and Terns.

1. (47). *Larus marinus* Linn. Great Black-backed Gull.

This species was listed by J. A. Allen (White's Geol. of Iowa, ii, 1870, p. 427). It is included in the Nebraska list on Aughey's record of a specimen shot on the Missouri River and brought to Dakota City in May, 1871 (Rev. Bds. Neb., p. 19). C. K. Salisbury reported the species as a rare transient in Blackhawk county. The species occurs on the Great Lakes in winter.

2. (40). *Rissa tridactyla* (Linn.). Kittiwake.

George H. Berry writes: "Rare summer resident (Dickinson county). I did not shoot any of the birds, but from what I could see of them would place them as the Kittiwake. In 1891 they bred on an island in Loon Lake, Minn., about a mile beyond Spirit Lake, and I found about a dozen nests with young on a small lake about three-quarters of a mile southeast of Spirit Lake, on the prairie. They were not the Herring Gull, and from the best of my recollection (the Kittiwake being very abundant on the coast of Maine, my old home), it exactly resembles the Kittiwake." The Kittiwake has been taken quite frequently on the Great Lakes, but it is doubtful if it ever occurs in Iowa except as a rare straggler.

3. (63). *Gelochelidon nilotica* (Hasselq.). Gull-billed Tern.

The Gull-billed Tern was included by J. A. Allen in his list (1870). Thomas Say reported the "Marsh Tern" (*Sterna aranea* Wilson) at Engineers' Cantonment in 1819–20, but perhaps referred to the Black Tern (Long's Exp.). The species is of southern distribution, but has been recorded from Illinois and Michigan.

Family ANATIDÆ. Ducks and Geese.

4. (138). *Nettion crecca* (Linn.). European Teal.

John Krider states: "*Nettion crecca* Kaup. English Teal. I found two specimens in the year 1874 in Winnebago county, Iowa. Rare" (Forty Years' Notes, p. 72). This species is of casual occurrence in North America, closely resembling *N. carolinensis*.

5. (176). *Philacte canagaca* (Sevast.). Emperor Goose.

The Emperor Goose is a species of the Northwest coast, from Alaska south to California; rare in the United States. J. G. Smith reported the Emperor Goose as occurring at Algona, Iowa (*Forest and Stream*, xviii, 6, 1882, p. 107). Prof. C. C. Nutting reported a specimen taken at Coralville, Johnson county, Iowa, in 1892 (Report of Com. on State Fauna, Proc. Iowa Acad. Sci., 1892, p. 40). This was probably a mistaken identification, as Prof. Nutting says it was identified by him from a verbal description by Mr. Paintin.

Family IBIDIDÆ. The Ibises.

6. (184). *Guara alba* (Linn.). White Ibis.

"Coming north regularly to southern Indiana and southern Illinois (Ridgway). Dr. Agersborg shot a specimen and saw another in southeastern Dakota in May, 1879" (Cooke, Bird Migr. in Miss. Val., 1884–85, p. 20).

Family CICONIIDÆ. The Storks.

7. (188). *Tantalus loculator* Linn. Wood Ibis.

This species was listed by J. A. Allen (White's Geol. of Iowa, 1870, ii, p. 426). Kumlien and Hollister state: "There are recorded several captures of this southern species within the state. Can be classed only as a very rare midsummer straggler at the present day, however" (Birds of Wis., 1903, p. 32). "A few

ascend the Mississippi Valley, where they have been taken in Indiana, Illinois, Missouri, Wisconsin and Kansas" (Cooke, Bird Migr. in Miss. Val., 1884–85, p. 80).

Family SCOLOPACIDÆ. Snipes, Sandpipers.

8. (234). *Tringa canutus* Linn. Knot.

The Knot was listed by J. A. Allen (White's Geol. of Iowa, 1870, ii, p. 426), and reported by John Krider, who "found it in the month of May, marching westward, stopping a day or two in Iowa, feeding along the sloughs. Very easy to approach" (Forty Years' Note, 1879, p. 64). It was taken once by Dr. Hvoslef at Lanesboro, Minn., [near the Iowa line] (Cooke, Bird Migr. in Miss. Val., 1884–85, p. 92). Kumlien and Hollister state that "Thirty years ago it was a rather common migrant in May and June, and more sparingly in autumn; of late years decidedly rare at any season" (Birds of Wis., 1903, p. 45). It has been reported from Kansas (Snow), Illinois (Ridgway), and once from Nebraska, at Omaha, September 30, 1893 (Trostler).

9. (235). *Arquatella maritima* (Brünnich). Purple Sandpiper.

The Purple Sandpiper was listed by Allen (White's Geol. of Iowa, 1870, ii, p. 425); reported from western Missouri (Hoy, Smithsonian Rept., 1864, p. 538); Illinois (Ridgway, Ann. Lyc. N. Y., x, 1874, p. 384); Wisconsin (Kumlien and Hollister, Birds of Wis., 1903, p. 45).

10. (326). *Catharista urubu* (Vieill.). Black Vulture.

"Breeds in Lower Sonoran and Tropical Zones from the Atlantic to western Texas and from N. C., Ind. and Kan. south over most of South America. Straggles to N. E. and South Dakota" (F. M. Bailey, Handbook Birds West. N. A., p. 146). Kumlien and Hollister state: "We do not consider the records of this species for Wisconsin sufficiently authentic to warrant us in giving it a place at the present time. Will no doubt straggle to the state at some time via the Mississippi River" (Birds of Wis., 1903, p. 131).

Family BUBONIDÆ. Horned Owls, etc.

11. (371). *Cryptoglaux tengmalmi richardsoni* (Bonap.). Richardson Owl.

This is a northern species, ranging south in winter to northern

United States. It was listed by Allen (White's Geol. of Iowa, 1870, ii, p. 424), and given by Cooke as "occurring in winter in Minnesota, Wisconsin and Iowa" (Bird Migr. in Miss. Val., 1884–85, p. 121). It has been reported from Illinois—at Kenilworth, December 26, 1902 (Deane, Auk, xx, :903), and Rockford, October 15, 1884 (O. & O., x, 1885).

G. H. Berry reports the species as a rare winter visitant in Linn county, and M. P. Somes as rare in Webster county. No specimens have been taken, however.

Family TYRANNIDÆ. Tyrant Flycatchers.

12. (462). *Contopus richardsoni* (Swainson). Western Wood Pewee.

The Western Wood Pewee is listed as a common summer resident in western Nebraska; east, but not common, to Dismal River, Thomas county; also reported from Sidney and Wood River" (Rev. Birds Neb., pp. 67–8). Kumlien and Hollister state: "Several typical Western Wood Pewees have been taken at Lake Koshkonong. One pair, with nest and eggs, were identified by Dr. Coues as unquestionably of this species" (Birds of Wis., 1903, p. 82). As Iowa is midway between these points, the species may unquestionably be expected to occur in the state.

Family FRINGILLIDÆ. Finches, Sparrows, etc.

13. (527a). *Acanthis hornemanni exilipis* (Coues). Hoary Redpoll.

"South in winter, occasionally to the northern U. S. Occasionally from Mass., Ill., Maine, and Mich." (Bailey, Birds West. N. A., p. 318). The species was reported from Linn county as a rare winter visitant by G. H. Berry, but no specimens have been preserved.

14. (547a). *Ammodramus henslowi occidentalis* Brewst. Western Henslow Sparrow.

This form of the Henslow Sparrow very probably occurs in western Iowa. Its habitat is given as "South Dakota in summer. (Range very imperfectly known)" (Ridgway, Birds of N. and Mid. Am., i, p. 228). In Nebraska, "a rare migrant. It may occasionally breed locally in the state, since Trostler took a set of eggs, with female bird, at Omaha, belonging to this species and probably to this form" (Rev. Birds Neb., p. 86).

15. (557). *Zonotrichia coronata* (Pall.). Golden-crowned Sparrow.

This Western bird has been taken several times in Wisconsin, near Racine, from 1853 to 1858, both spring and fall, by Dr. Hoy (Birds of Wis., 1903, p. 99). John Krider states: "I shot one of these birds in September, 1872, in a garden in Lake Mills, Winnebago county, Iowa" (Forty Years' Notes, p. 47). Referring to this record, Witner Stone, of the Philadelphia Academy of Science, says: "His *Z. coronata* may be a female or young of *Z. querula* or the last (*Z. leucophrys gambeli*)." M. E. Halvorsen reports a specimen taken at Forest City, Winnebago county, saying: "I identified the bird for Dr. Irish, but may have been mistaken."

16. (588). *Pipilo maculatus arcticus* (Sw.). Arctic Towhee.

Dr. Coues gives the range of this species as "Central region of North America from limit of *erythrophthalmus* in Kansas, Nebraska and Dakota to that of *oregonus* in Oregon, Washington and British Columbia, etc." "Casually to Iowa (Dubuque), and even to Wisconsin (Milwaukee)" (Ridgway, Birds N. and Mid. Am., i, p. 423; Nelson, Bull. Essex. Inst., viii, 1876, p. 110). Kumlien and Hollister state that one was noted by Dr. Hoy in a collection of birds at Dubuque, which had been taken on the Wisconsin side of the river. One specimen has been shot in Jefferson county and another near Milwaukee (Bds. of Wis., p. 102). "Northern and western Nebraska in summer, whole state during migration—east in Niobrara valley to its mouth—West Point, Omaha, etc." (Rev. Bds. Neb., p. 91). I carefully examined a large series of Towhees from western Iowa, Sioux City, etc., in the Talbot collection, but was unable to find a specimen referable to *Pipilo maculatus arcticus*, all the Iowa birds being unmistakably *erythrophthalmus*.

17. (597). *Zamelodia melanocephala* (Swainson). Black-headed Grosbeak.

There are no Iowa records, but in Nebraska it is reported "during migration over the state, rarely to Neligh, York, Omaha" (Rev. Bds. Neb., 1904, p. 91).

18. (597). *Guiraca cærulea lazula* (Lesson). Western Blue Grosbeak.

The Blue Grosbeak was listed by Allen (White's Geol. of Iowa, 1870, ii, p. 422). A rare straggler in Wisconsin, probably the Eastern variety, was taken at Lake Koshkonong, Milwaukee, etc. (Birds of Wis., p. 102). In Nebraska, "over the entire state, locally common summer resident and breeder . . . less common [eastern Nebraska], Grand Island, Red Cloud, Beatrice, Omaha and Lincoln (Rev. Birds Neb. p. 91).

Family TANAGRIDÆ. Tanagers.

19. 607. *Piranga ludoviciana* (Wilson). Louisiana Tanager.

The Louisiana Tanager was reported by Thomas Say from Engineers' Cantonment in 1819–20 (Long's Exp., i, p. 263). "Common summer resident in northwest Nebraska" (Rev. Bds. Neb., 1904, p. 93). "Straggles eastward in migration to the Atlantic states" (Bailey, Bds. Wn. U. S., p. 379). "During the latter part of May, 1877, Thure Kumlien found this species nesting in Jefferson county [Wisconsin]. Nest, eggs and parents were secured and are now preserved in the museum of the State University at Madison . . . A second male was procured the next June (1878); and in July, 1891, another, also an adult male, was shot in the same locality by L. Kumlien" (Bds. of Wis, p. 103).

Family MNIOTILTIDÆ. Wood Warblers.

20. (670). *Dendroica kirtlandi* (Baird). Kirtland Warbler.

This is one of the rarest species of North American Warblers. Frank M. Chapman (Auk, xv, 1898, pp. 289–93, and xvi, 1899, p. 80) records the total number of specimens taken as 75,—in Bahamas, 55; in the United States, 20. "Has been taken in the following states: Ohio, Indiana, Illinois (Winnebago and Cook counties), Missouri (St. Louis county), Minnesota (Minneapolis), Wisconsin (Racine), Michigan (Ann Arbor), Virginia and South Carolina." See "The Migration Route of Kirtland's Warbler," by Chas. C. Adams. Bull. Mich. Ornith. Club, Vol. V, pp. 14–21, March, 1904.

Geo. H. Berry writes: "In Linn county I found a dead Warbler (male, I think) that as near as I could, I identified as this

species. Would not be sure, as the way I chanced to notice it was by the sexton beetles moving it." The species will undoubtedly be taken in Iowa, as the state lies in the Mississippi River migration route and specimens have been taken both north and south of us.

Family TURDIDÆ. Thrushes.

21. (754). *Myadestes townsendi* (Aud.). Townsend Solitaire.

"A rare straggler from the western United States. The only accounts of it in the Mississippi Valley district refer to its occasional occurrence in winter" [Niobrara River, Neb., in 1877; Alda, Neb., Jan. 17, 1880; southeastern Nebraska. One was killed at Waukegan, Ill., Dec. 16, 1875—Nelson], (Cooke, Bird Migr. in Miss. Val., 1884-85, p. 282). "Resident in northwestern Nebraska . . . in winter spreading eastward over entire state" (Rev. Bds. Neb., p. 114).

22. (756a). *Hylocichla fuscescens salicicolus* (Ridgw.). Wilson Thrush.

This western form of the Wilson Thrush has been taken as an accidental straggler at Chicago, Ill., Sept. 16, 1877, by H. K. Coale (Cooke, Bird Migr. in Miss. Val., 1884-85, p. 284). "A single specimen taken at Delevan, Wis., May 6, 1899, and identified by Mr. Wm. Brewster, is the sole claim for introducing this species here. We are of the opinion that a careful examination of the migratory *fuscescens* will reveal numbers of this form, especially, it would seem, in the western part of the state" (Kumlien and Hollister, Bds. of Wis., p. 126).

23. (758c). *Hylocichla ustulata almæ* Oberholser. Alma Thrush.

This western variety of the Olive-backed Thrush is a common migrant in western Nebraska (Rev. Bds. Neb., p. 115). "Among specimens of Thrushes sent Mr. Wm. Brewster for examination were two of this subspecies. Both were shot at Lake Koshkonong early in May. The difference was detected at once on comparing with others of *swainsoni*, and it must be very uncommon in Wisconsin, although Mr. Brewster later pronounced a specimen from Delevan as 'almost if not quite gray enough for *almæ*'" (Kumlien and Hollister, Bds. of Wis., p. 127).

24. (768). *Sialia arctica* Swains. Mountain Bluebird.

This species has occurred accidentally in Illinois, opposite Dubuque, Iowa (Cooke, Bird Migr. in Miss. Val., 1884-85, pp. 294-5). Dr. Hoy examined a specimen of this species in a local collection, said to have been shot in Wisconsin across the river from Dubuque, Iowa. In a personal letter to L. K. he says: "There can be no doubt of this record;" and adds that "a second specimen was taken near La Crosse late in the autumn of 1856" (Bds. of Wis., p. 134).

SUMMARY

Species found more or less regularly in Iowa	308
Casual or accidental	43
Imported from Europe	1
Extinct	1
Whole numbers actually recorded in the state	353
Hypothetical	24
Number of species treated in this list	377

BIBLIOGRAPHY.

In this appendix appear the names of the most important books, catalogues, and periodicals containing references to Iowa birds, and other papers which have been consulted in the preparation of this list. In the pursuance of the work, the writer must acknowledge the great aid received from the manuscript thesis of Dr. Paul Bartsch of the Smithsonian Institution on "The Literature of Iowa Birds," presented to the State University of Iowa in 1899 as a thesis for the degree of Master of Science (3 vols., Univ. Library, Nos. 57,302-3-4). This contains most of the important published references to the birds of Iowa, from 1894 to 1899. All quotations in the present work have been verified by the writer from the original sources, unless otherwise stated. The list has been arranged chronologically in the order of publication.

1814.

LEWIS AND CLARKE.—History of the Expedition under the command of Captains Lewis and Clarke, to the sources of the Missouri, thence across the Rocky Mountains and down the River Columbia to the Pacific Ocean. Performed during the years 1804-1805-1806. By order of the government of the United States. Philadelphia: 1814. 8vo, 2 vols. [Not available, except through Dr. Coues' 1893 edition].

1823.

SAY, THOMAS.—Account of an Expedition from Pittsburg to the Rocky Mountains, performed in the years 1819, 1820. By order of the Hon. J. C. Calhoun, Secretary of War, under the command of Major Stephen H. Long, of the U. S. Top. Engineers. Compiled from the notes of Major Long, Mr. T. Say, and other gentlemen of the exploring party, by Edwin James, Botanist and Geologist to the Expedition. In three volumes, I, II, III. London: Printed for Longman, Hurst, Rees, Orme, and Brown. Paternoster Row. 1823.

1839-1841.

MAXIMILIAN, PRINZ ZU WIED.—Reise in das Innere Nord-America in den Jahren 1832 bis 1835 von Maximilian, Prinz zu Wied. Mit 48 Kupfern, 33 Vignetten, vielen Holzschnitten und einer Charte. Einer [Zweiter] Band. Coblenz: 1839 [1841]. Bei J. Hoelscher. 2 vols., 4to.

1843.

MAXIMILIAN, PRINCE OF WIED.—Travels in the Interior of North America. By Maximilian, Prince of Wied. With numerous engravings on wood, and a large map. Translated from the German by H. Evans Loyd.

To accompany the original series of eighty-one elaborately colored plates, size, imperial folio. London: Ackerman & Co., 96 Strand. 1843. [Not available].

1844.

AUDUBON, JOHN JAMES.—The Birds of North America, from drawings made in the United States and their Territories. By John James Audubon, F. R. SS. L. & E.; Fellow of the Linnæan and Zoölogical Societies of London; Member of the Lyceum of Natural History of New York, of the Natural History Society of Paris, the Wernerian Natural History Society of Edinburgh. Honorary Member of the Society of Natural History of Manchester and of the Royal Scottish Academy of Painting, Sculpture and Architecture; Member of the American Philosophical Society, of the Academy of Natural Sciences of Philadelphia, of the Natural History Societies of Boston, of Charleston in South Carolina, the Quebec Literary and Historical Society, the Ornithological Society in London, the Societé Francaise de Statistique Universelle de Paris, etc., etc. J. J. Audubon, 77 William Street, N. Y., 34 North Front Street, Philadelphia. 1844. 8 vols.

1858.

BAIRD, CASSIN AND LAWRENCE.—Thirty-third Congress, 2nd Session. House of Representatives. Ex. Doc. No. 91. Reports of Explorations and Surveys, to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean. Made under the direction of the Secretary of War, in 1853-6, according to Acts of Congress of March 3d, 1853, May 31st, 1854, and Aug. 5, 1854. Vol. IX. Washington: A. O. P. Nicholson, Printer. 1858. 4to. Subtitled as follows: Explorations and Surveys for a Railroad from the Mississippi River to the Pacific Ocean. War Department.

Birds: By Spencer F. Baird, Assistant Secretary Smithsonian Institution, with the coöperation of John Cassin and George N. Lawrence. Washington, D. C. 1858.

1860.

BAIRD, S. F.—The Birds of North America; the description of species based on the collections in the Museum of the Smithsonian Institution, with the coöperation of John Cassin of the Academy of Natural Science of Philadelphia, and George N. Lawrence of the Lyceum of Natural History of New York, With an Atlas of One Hundred Plates. Text. Philadelphia: J. B. Lippincott & Co. 1860. 4to.

1863.

HAYDEN, F. V.—"On the Geology and Natural History of the Upper Missouri." Transactions of the American Philosophical Society, held in Philadelphia, for Promoting Useful Knowledge. Vol. XII. New Series. Published by the Society. Philadelphia: C. Sherman, Son & Co., Printers. 1863.

1864.

BAIRD, S. F.—Smithsonian Miscellaneous Collection. 181. Review of American Birds in the Museum of the Smithsonian Institution, by S. F. Baird. Part I. North and North America. Washington: Smithsonian Institution. [Dated June, 1864].

1868.

ALLEN, J. A.—"Notes on the Birds observed in western Iowa, in the months of July, August and September; also on Birds observed in northern Illinois in May and June, and at Richmond, Wayne Co., Indiana, between June third and tenth." Memoirs read before the Boston Society of Natural History. Being a new series of the Boston Journal of Natural History. Vol. I. Boston: Published by the Society. New York: William Wood & Co., 61 Walker St.; 440 Broadway; L. W. Schmidt, 24 Barclay St., London; Trübner & Co., 60 Paternoster Row, E. C. 1866–1869. Pp. 488–526.

1870.

ALLEN, J. A.—Catalogue of the Birds of Iowa. Report on the Geological Survey of the State of Iowa, by Charles A. White. Vol. II, 1870. Appendix B. Pp. 419–427.

1873.

TRIPPE, T. MARTIN.—"Notes on the Birds of Southern Iowa" [Decatur and Mahaska Counties]. Proceedings of the Boston Society of Natural History, Vol. xv, 1872–1873. Boston. 1873.

1874.

BAIRD, BREWER AND RIDGWAY.—A History of North American Birds, by S. F. Baird, T. M. Brewer and R. Ridgway. Land Birds. Illustrated by 64 colored plates and 593 woodcuts. Vols. I–III. Boston: Little, Brown & Company. 1874.

COUES, ELLIOTT.—Department of the Interior. United States Geological Survey of the Territories. F. V. Hayden, U. S. Geologist in Charge. Miscellaneous Publications No. 3. Birds of the Northwest. A Handbook of the Ornithology of the Region drained by the Missouri River and its Tributaries. By Elliott Coues, Captain and Assistant Surgeon, U. S. Army. Dept. of Int., U. S. Geol. Survey. Miscell. Pub. No. 3. Washington. 1874.

1875.

HENSHAW, H. W.—Chapter III. Report upon the Ornithological collections made in portions of Nevada, Utah, California, Colorado, New Mexico, and Arizona, during the years 1871, 1872, 1873, 1874. By H. W. Henshaw. Vol. V of the Geographical and Geological Explorations and Surveys west of the 100th Meridian. Lt. Geo. M. Wheeler in charge. 1875.

1878.

COUES, ELLIOTT.—Department of the Interior. United States Geological Survey of the Territories. F. V. Hayden, U. S. Geologist, in Charge.

Miscellaneous Publications No. 11. Birds of the Colorado Valley. A Repository of Scientific and Popular Information concerning North American Ornithology. By Elliott Coues. Part First. Passeres and Laniidæ. Bibliographical appendix. Seventy Illustrations. Washington: Government Printing Office. 1878.

1879.

KRIDER, JOHN.—Forty Years' Notes of a Field Ornithologist. By John Krider, Member of the Philadelphia Academy of Natural Sciences and author of Krider's Sporting Anecdotes. Giving a description of all birds killed and prepared by him. Philadelphia: Press of Joseph H. Weston, 438 Walnut Street. 1879.

1880.

ROBERTS. T. S.—"The Winter Birds of Minnesota." The Geological and Natural History Survey of Minnesota. Ninth Annual Report. 1880.

1881.

FOREST AND STREAM.—An Index and Summary of all the Ornithological Matter contained in "Forest and Stream," Vols. I-XII, compiled by H. L. Bailey. New York. 1881.

1883.

STEARNS, W. A.—The Utility of Birds in Agriculture and in Migration. By Prof. W. A. Stearns, Amherst, Mass. [From the Report of the Secretary of Connecticut Board of Agriculture, 1882]. Hartford, Conn.: 1883. Pp. 1-37.

1884.

BAIRD, BREWER AND RIDGWAY.—Memoirs of the Museum of Comparative Zoölogy at Harvard College. Vol. XII. The Water Birds of North America, by S. F. Baird, T. M. Brewer and R. Ridgway. Issued in continuation of the publications of the Geological Survey of California. J. D. Whitney, State Geologist. Vol. I-II. Boston: Little, Brown & Co. 1884.

COUES, ELLIOTT.—Key to North American Birds. Containing a concise account of every species of living and fossil bird at present known from the continent north of the Mexican and United States Boundary, inclusive of Greenland. Second Edition. By Elliott Coues, M. D., M. A., Ph. D., Member of the National Academy of Sciences, etc., etc. Boston: Estes & Lauriat. 1884.

1886.

THE CODE OF NOMENCLATURE and CHECK LIST of North American Birds adopted by the American Ornithologist's Union. Being the report of the committee of the Union on Classification and Nomenclature. Zoölogical nomenclature is a means, not an end, of Zoölogical Science. New York: 1886. [Fifteen supplements to this have appeared in "The Auk," the official quarterly publication of the A. O. U.]

1887.

COUES, ELLIOTT.—Key to North American Birds. Containing a concise account of every known species of living and fossil bird at present known from the continent north of the Mexican and United States Boundary, inclusive of Greenland and Lower California, with which are incorporated: General Ornithology, an outline of the structure and classification of Birds and Field Ornithology, a manual of collecting and preserving birds. The Third Edition, exhibiting the nomenclature of the American Ornithologists' Union, and including description of additional species, etc. By Elliott Coues, A. M., M. D., Ph. D., Late Captain and Assistant Surgeon in the U. S. Army, and Secretary of the U. S. Geological Survey; Vice-President of the American Ornithologists' Union, and Chairman of the Committee on the Classification and Nomenclature of the North American Birds. Foreign Member of the British Ornithologists' Union; Corresponding Member of the Zoölogical Society of London; Member of the National Academy of Science, of the Faculty of the National Medical College, of the Philosophical and Biological Societies of Washington, of the General Council of the Theosophical Society of India, etc. Profusely illustrated. Boston: Estes & Lauriat. 1887.

FISHER, A. K.—"Notes on the Depredations of the Blackbirds and Gophers in Northern Iowa and Southern Minnesota in the Fall of 1887." Annual Report of the Department of Agriculture. Washington. 1877. Pp. 454–6.

RIDGWAY, ROBERT.—A Manual of North American Birds, by Robert Ridgway. Illustrated by 464 outline drawings of the generic characters. Philadelphia: J. B. Lippincott Company. 1887.

1888.

COOKE, W. W.—U. S. Department of Agriculture. Division of Economic Ornithology. Bulletin No. 2. Report on Bird Migration in the Mississippi Valley in the Years 1884 and 1885, by W. W. Cooke. Edited and revised by C. Hart Merriam. Washington: Government Printing Office. 1888.

1889.

BARROWS, W. B.—U. S. Dept. of Agriculture. Division of Economic Ornithology and Mammalogy. Bulletin 1. The English Sparrow (Passer domesticus) in North America, especially in Its Relations to Agriculture. Prepared under the direction of Dr. C. Hart Merriam, Ornithologist, by Walter B. Barrows, Asst. Ornithologist. Washington: Government Printing Office. 1889.

KEYES AND WILLIAMS.—A Preliminary Annotated Catalogue of the Birds of Iowa, by Chas. R. Keyes and H. S. Williams, M. D. Proceedings of the Davenport Academy of Natural Sciences. Vol. V, 1889, pp. 113–161. Davenport. 1889. [Reprint; Extract from same. Davenport, Iowa. 1889. Pp. 1–49].

1891.

GOSS, N. S.—History of the Birds of Kansas, by N. S. Goss. Illustrating 529 Birds. Topeka, Kansas: Geo. W. Crone & Co., Printers and Binders. 1891.

1892.

BENDIRE, CHAS.—Life Histories of North American Birds, with special reference to their breeding habits and eggs, with twelve lithographic plates, by Charles Bendire, Captain U. S. Army (Retired), Honorary Curator of the Department of Oölogy, U. S. National Museum, Member of A. O. U. Smithsonian Institution. United States National Museum. Special Bulletin No. 1. Washington. 1892.

BUTLER, AMOS W.—The Birds of Indiana, with Illustrations of many of the species. Prepared by the Indiana Horticultural Society and Originally published in the Transactions for 1890, by Amos W. Butler of Brookville. Wm. B. Bradford, Printer. 1892.

HATCH, P. L.—The Geological and Natural History of Minnesota. First Report of the State Zoölogist, accompanied with notes on the Birds of Minnesota, by Dr. P. L. Hatch. Henry F. Nachtrieb, State Zoölogist. June, 1892. Minneapolis: Harrison & Smith, Printers. 1892.

OSBORN, HERBERT.—A Partial Catalogue of the Animals of Iowa Represented in the collection of the Department of Zoölogy and Entomology of the Iowa Agricultural College. Prepared by Herbert Osborn. Published by Authority of the Board of Trustees. Ames, Iowa. 1892.

1893.

COUES, ELLIOTT.—History of the Expedition under the command of Lewis and Clarke to the source of the Missouri River, thence across the Rocky Mountains and down the River Columbia to the Pacific Ocean, performed during the years 1804–5–6, by order of the Government of the United States. A New Edition, Faithfully reprinted from the only authorized edition of 1814, with copious, critical commenting, prepared upon examination of unpublished official archives and many other sources of information, including a diligent study of the original manuscript journals and field notebooks of the explorers, together with a new biographical and bibliographical introduction, new maps, and other illustrations, and a complete index, by Elliott Coues, Late Captain and Assistant Surgeon U. S. Army, and Secretary and Naturalist of the Geological Survey. In four volumes. New York: Francis P. Harper. 1893.

FISHER, A. K.—U. S. Department of Agriculture, Division of Ornithology and Mammalogy. Bulletin No. 3. The Hawks and Owls of the United States in their relation to Agriculture. Prepared under the direction of Dr. C. Hart Merriam, Ornithologist, by A. K. Fisher, M. D., Assistant Ornithologist. Washington: Government Printing Office. 1893.

NEHRLING, H.—North American Birds. By H. Nehrling. With 36 colored plates after water color paintings by Robert Ridgway, Smithsonian Institution, Washington, D. C., Prof. A. Gaering, Leipzig, and Gustave Nuetzel, Berlin. Milwaukee, Wis. [Published in parts. 1893–1897].

JORDAN, DAVID STARR.—A Manual of the Vertebrate Animals of the Northern United States, including the district north and east of the Ozark Mountains, south of the Laurentian Hills, north of the southern boundary of Virginia, and east of the Missouri River, inclusive of Marine Species. By David Starr Jordan, President of the University of Indiana. Seventh Edition. Chicago: A. C. McClurg & Company. 1894.

COOK, A. J.—Bulletin 94. April, 1893. Michigan Agricultural Experiment Station, State Agricultural College. Zoölogical Department. Birds of Michigan. Illustrated. By A. J. Cook.

1895.

BEAL, F. E. L.—Bulletin No. 7. U. S. Department of Agriculture. Division of Mammalogy and Ornithology. Preliminary Report on the Food of the Woodpeckers, by F. E. L. Beal, Assistant Ornithologist. Washington: Government Printing Office. 1895.

BENDIRE, C.—Smithsonian Institution, U. S. National Museum. Special Bulletin. Life Histories of North American Birds, from the Parrot to the Grackles, with special reference to their breeding habits and eggs, by Charles Bendire, Captain and Brevet Major U. S. Army (Retired), Honorary Curator of the Department of Oölogy of the United States National Museum, Member of the American Ornithological Union; with seven lithographic plates. Washington: Government Printing Office. 1895. Also published as "Smithsonian Contributions to Knowledge," No. XXVIII. 1892.

GRUNTWIG, F. L.—On the Birds of Shiocton in Bovina, Outagamie County, Wisconsin. Transactions of the Wisconsin Academy of Science, Letters and Arts. Vol. 10. 1894–5. Translated by Charles E. Faxon, from the Videnskabelige Meddelser fra den Naturhistoriske Forening i Kjobnhavn for Aaret 1887. Copenhagen. 1888.

CHECK LIST OF NORTH AMERICAN BIRDS. Prepared by a Committee of the American Ornithologists' Union. Second and Revised Edition. Zoölogical Nomenclature is a means, not an end, of Zoölogical Science. New York: American Ornithologists' Union. 1895.

RIDGWAY, ROBERT.—Natural History Survey of Illinois. Laboratory of Natural History. S. A. Forbes, Director. The Ornithology of Illinois. Part 1. Descriptive Catalogue, by Robert Ridgway. Vol. 2. Part 1. Published by Authority of the State Legislature. Springfield, Ill.: H. W. Rokker, Printer and Binder.

1896.

BRUNER, LAWRENCE.—Some Notes on Nebraska Birds. A list of the species and subspecies found in the state, with notes on their distribution,

habits, etc., corrected to April 22d, 1896. By Lawrence Bruner, Professor of Entomology and Ornithology, University of Nebraska. [Reprint from the Report of the Nebraska State Horticultural Society for the year 1896]. Lincoln, Neb.: State Journal Company, Printers. 1896.

COUES, ELLIOTT.—Key to North American Birds. Fourth Edition. Boston. 1896.

RIDGWAY, ROBERT.—A Manual of North American Birds. Second Edition. Philadelphia. 1896.

SHOEMAKER, FRANK H.—A Partial List of the Birds of Franklin County, Iowa. Compiled by Frank H. Shoemaker. Hampton, Iowa. 1896.

1897.

ANDERSON, R. M.—A List of the Birds of Winnebago and Hancock Counties, Iowa. With notes on 216 species, by Rudolph M. Anderson. Forest City, Iowa. 1897.

AUDUBON, M. R. AND COUES, E.—Audubon and his Journals, by Maria R. Audubon, with Zoölogical and other notes by Elliott Coues. New York. 1897. 2 Vols.

BEAL, F. E. L.—Birds that Injure Grain. Yearbook of the U. S. Department of Agriculture. 1897.

1898.

DAVIE, OLIVER.—Nests and Eggs of North American Birds, by Oliver Davie, author of "Methods in the Art of Taxidermy." The Fifth Edition. Revised, Augmented and Illustrated. Columbus: The London Press. 1898.

1899.

CORY, CHARLES B.—The Birds of Eastern North America known to occur east of the Ninetieth Meridian. Water Birds. Part 1. Key to the Families and Species, by Charles B. Cory, Curator of the Department of Ornithology in the Field Columbian Museum, Chicago; Vice-President of the American Ornithologists' Union; Fellow of the Linnæan and Zoölogical Societies of London; Member of the British Ornithologists' Union; Honorary Member of the California Academy of Sciences; Cor. Member New York Academy of Sciences, etc., etc. Author of "The Beautiful and Curious Birds of the World," "The Birds of the Bahama Islands," "The Birds of Haiti and San Domingo," "The Birds of the West Indies," "A Naturalist in the Magdalen Islands," "Hunting and Fishing in Florida," "Key to the Water Birds of Florida," "How to Know the Shore Birds of North America," "How to Know the Ducks, Geese and Swans," etc., etc. Special Edition. Printed for the Field Columbian Museum, Chicago, Ill. 1899. Ibid. Land Birds. Part II.

BARTSCH, PAUL.—The Literature of Iowa Birds. A Complete Record of the Published Writings on the Birds of Iowa. Consisting, First, of a list

of the species with the references to each chronologically arranged under it; Second, a Bibliography citing the papers published annually from the time of the Lewis and Clark Expedition (1804) to the present date (1899). By Paul Bartsch. Presented to the State University of Iowa as "A Thesis for the Degree of Master of Science." [In Mss. (typewritten), 3 vols., bound. University Library, Sec 5892, Nos. 57302-3-4].

1900.

JONES, LYNDS.—Laboratory Bulletin. No. 10. Oberlin College. The Songs of the Warblers (Mniotiltidæ). Lynds Jones, M. S. Instructor in Zoölogy. Also issued as a Wilson Bulletin, No. 30. Oberlin, Ohio. March 20, 1900.

1901.

RIDGWAY, ROBERT.—Smithsonian Institution. United States National Museum. No. 50. Washington: Government Printing Office. 1901. The Birds of North and Middle America. A descriptive catalogue of the higher groups, genera, species and subspecies of birds known to occur in North America, from the Arctic Lands to the Isthmus of Panama, the West Indies, and other Islands of the Caribbean Sea, and the Galapagos Archipelago. By Robert Ridgway, Curator, Division of Birds. Part I. Family Fringillidæ—The Finches. Washington: Government Printing Office. 1901.

1902.

BAILEY, F. M.—Handbook of Birds of the Western Unites, including the Great Plains, Great Basin, Pacific Slope, and Lower Rio Grande Valley, by Florence Merriam Bailey, with thirty-three full-page plates by Louis Agassiz Fuertes, and over six hundred cuts in the text. Boston and New York: Houghton, Mifflin & Company. The Riverside Press, Cambridge. 1902.

PREBLE, E. A.—U. S. Department of Agriculture. Division of Biological Survey. North American Fauna, No. 22. A Biological Investigation of the Hudson Bay Region by Edward A. Preble, Assistant Biologist, Biological Survey. Prepared under the Direction of Dr. C. Hart Merriam, Chief of Division of Biological Survey. Washington: Government Printing Office. 1902.

RIDGWAY, R.—Birds of North and Middle America. Part II. Family Tanagridæ—The Tanagers. Family Icteridæ—The Troupials. Family Cœrebidæ—The Honey-creepers. Family Mniotiltidæ—The Wood Warblers. Washington: Government Printing Office. 1902.

1903.

COOKE, W. W.—Some New Facts about the Migration of Birds, by Wells W. Cooke, Assistant, Biological Survey. Reprint from Yearbook of Department of Agriculture for 1903.

JONES, LYNDS.—Ohio State Academy of Science. Special Papers No. 6. The Birds of Ohio. A Revised Catalogue by Lynds Jones, M. Sc., Oberlin

College. Published by the Academy of Science with the Emerson McMillan Research Fund. Publication Committee: J. H. Schaffner, L. H. McFadden, Gerard Fowke. October 15, 1903.

KUMLIEN AND HOLLISTER.—Bulletin of the Wisconsin Natural History Society. Vol. 3 (new series). January, April, July, 1903, Nos. 1, 2, and 3. The Birds of Wisconsin. By L. Kumlien and N. Hollister. Published with the coöperation of the Board of Trustees of the Milwaukee Public Museum. Milwaukee, Wisconsin.

CHAPMAN, F. M.—Handbook of Birds of Eastern North America, with Keys to the species and description of their plumage, nests, and eggs, their distribution and migrations and a brief account or their haunts and habits, with introductory chapters on the study of Ornithology, etc., by Frank M. Chapman, Assistant Curator of the Department of Mammalogy and Ornithology in the American Museum of Natural History, New York City; Member of the American Ornithologists' Union, etc. With full-page plates in color and black and white, and upwards of one hundred and fifty cuts in the text. Sixth Edition. New York: D. Appleton & Co. 1902.

1904.

PAARMANN, J. H.—Davenport Academy of Sciences. Special Circular. Birds of Davenport and Vicinity. By J. H. Paarmann, Curator, Davenport Academy of Sciences. Davenport. 1903. Pp. 1-4.

ADAMS, C. C.—The Migration Route of Kirtland's Warbler. By Chas. C. Adams. [Bull. Mich. Ornith. Club, Vol. V, pp. 14-21, March, 1904]. From the University Museum, University of Michigan, Ann Arbor, Mich. 1904.

BRUNER, WOLCOTT, AND SWENK.—A Preliminary Review of the Birds of Nebraska, with Synopses, by Lawrence Bruner, Robert H. Wolcott, Myron H. Swenk. Klopp & Bartlett Co., Printing, Lithographing, Book Binding. Omahá, Neb. [1904].

RIDGWAY, ROBERT.—Birds of North and Middle America. Part III. Family Motacillidæ—The Wagtails and Pipits. Family Hirundinidæ—The Swallows. Family Ampelidæ—The Waxwings. Family Ptilogonatidæ—The Silky Flycatchers. Family Dulidæ—The Palm Chats. Family Vireonidæ—The Vireos. Family Laniidæ—The Shrikes. Family Corvidæ—The Crows and Jays. Family Paridæ—The Titmice. Family Sittidæ—The Nuthatches. Family Certhiidæ—The Creepers. Family Troglodytidæ—The Wrens. Family Cinclidæ—The Dippers. Family Chamæidæ—The Wren-Tits. Family Sylviidæ—The Warblers. Washington: Government Printing Office. 1904.

COUES, ELLIOTT.—Key to N. A. Birds. Fifth Edition. Revised and Enlarged. Two Vols. 1904.

The following periodicals and stated publications have contained many references to Iowa birds. Space forbids the enumeration of the notes, but many of the more important ones have been incorporated in the body of this work. Some of these publications have been ephemeral and are now almost unobtainable, and while many of their published notes have been of the amateur collector type, there has also been much of scientific value found in them:

American Naturalist.
Annals of Iowa. Des Moines.
Auk, The. New York City.
Bulletin of the Nuttall Ornithological Club. Continued as The Auk.
Bulletin Michigan Ornithological Club. Detroit, Mich.
Forest and Stream. New York City.
Iowa Ornithologist. Salem, Iowa. Discontinued.
Midland Monthly, The. Des Moines. Discontinued.
Museum, The. Discontinued.
Nidologist, The. Alameda, Cal. New York City. Discontinued.
Observer, The. Discontinued.
Oölogist, The. Albion, N. Y.
Oregon Naturalist, The. Oregon City, Ore. Discontinued.
Ornithologist and Botanist. Des Moines. Discontinued.
Ornithologist and Oölogist. Hyde Park, Mass. Discontinued.
Osprey, The. Washington, D. C.
Proceedings Davenport Academy of Sciences. Davenport.
Proceedings Iowa Academy of Sciences. Des Moines.
Proceedings United States National Museum. Washington.
Transactions Wisconsin Academy Science, Letters and Arts. Milwaukee.
Western Ornithologist, The. Avoca, Iowa. Discontinued.
Wilson Bulletin, The. Oberlin, Ohio.
Young Oölogist. Continued as Oölogist.

ADDENDA.

Family CAPRIMULGIDÆ. The Goat-suckers.

Genus PHALÆNOPTILUS Ridgway.

354. (418). *Phalænoptilus nuttalli* (Aud.). Poorwill.

The Poorwill is a species which has been reported from Iowa upon more or less questionable records, but seems to occasionally straggle into the state from the west.

Professor H. W. Cooke says: "The scarcity of the preceding species [Whippoorwill] on the plains has been noted. Its place there is taken by the present species, which is a rather common summer resident in Texas, Kansas, Nebraska, and Dakota, passing eastward, even to Grinnell, Iowa, where an accidental visitant was taken in 1880" (Bird Migr. in Miss. Val., 1884–85, p. 136). Colonel N. S. Goss (Birds of Kansas, 1891, p. 345) gives the range of the species as "western U. S., east into Iowa and Missouri;" and Major Charles Bendire (Life Hist. of N. A. Birds, ii, 1895, p. 153) as "casual east to Iowa and Missouri." Bruner, Wolcott, and Swenk give the status of the species in Nebraska as "western part of state, common; breeding in the canyons of Sioux county and east at least to Long Pine canyon, probably across the state northward." (Rev. Birds of Neb., 1904, p. 61).

Carl Kelsey gives the Poorwill as a "rare accidental visitant" in Poweshiek county (O. & O., xvi, 9, 1891, pp. 131–4), but Professor Lynds Jones of Oberlin, Ohio, in a letter of March 3, 1904, states that this was "Wrongly entered. Records based upon hearing alone . . . closely resembled the cry of the birds which I heard in Algona in 1900. I have suppressed the record."

Dr. Isidor S. Trostler gives the species as a "Very rare summer resident in Pottawattamie county. I took a set of two eggs May 5, 1895; bird shot almost to pieces, but enough saved to make identity certain."

Family FRINGILLIDÆ.

Genus DENDROICA Gray.

*310. (672). *Dendroica palmarum* (Gmel.). Palm Warbler.

The Palm Warbler or Red-poll Warbler is a common spring and fall migrant in the eastern and central portions of the state. I have found no recent records from western Iowa, although Audubon reports observing the "Yellow Red-poll Warbler" near Council Bluffs, May 10, 1843 (Journals, i, p. 481). "The only Nebraska record is a specimen taken at Omaha, May 4, 1893, by L. Skow" (Rev. Birds Neb., p. 104).

The Palm Warbler migrates rather early, usually in the latter part of April or first week of May. It has been taken as early as April 25, 1892, in Johnson county (M. E. Williams) and as late as May 11, 1897, in Winnebago county (R. M. Anderson). In Hancock and Winnebago counties I have found the species abundant at times. The fall migration occurs late in September. The species differs in habits from most of its congeners in frequenting fields, roadsides and low bushes, very rarely being seen in the larger trees.

ADDENDUM TO HYPOTHETICAL LIST.

Family FRINGILLIDÆ.

Genus PEUCÆA Audubon.

25. (575a). *Peucæa æstivalis bachmanii* (Audubon). Bachman Sparrow.

The Bachman Sparrow or Oak-woods Sparrow is a species of Southern distribution, and although there are no absolutely authentic Iowa records at hand, it is probable that the species occasionally straggles northward into the state. According to Professor Lynds Jones (Birds of Ohio, 1903, p. 150), it has appeared in Ohio since 1890, apparently from the southwest.

Keyes and Williams (Birds of Iowa, 1889, p. 144) enter the species in their list upon the strength of a set of five eggs taken near

*Omitted from body of work by mistake. *Dendroica palmarum* should follow *D. vigorsi* on page 337.

Des Moines, June 2, 1884, from a nest on the ground in a clover field. The bird was seen twice, but was not secured. Concerning this Professor J. A. Allen states (*Ibid*): "I have compared the eggs with those of *P. æstiva*, *P. cassini*, and *P. carpalis*, and with those of other species laying white or whitish eggs. Taking into consideration the situation of the nest—on the ground—and the geographical distribution of the other species of *Peucæa* and the few other species of Finch which lay white eggs, I should say that your conclusions that these eggs are those of *P. æstivalis bachmanii* is highly probable—in fact, almost beyond question."

Robert Ridgway (Birds of North and Middle Amer., i, p. 256) gives the distribution of the species [*Aimophila æstivalis bachmanii* (Audubon)] as "north to southern Virginia, Maryland, southern Indiana, southern Illinois (north, locally, at least to parallel of 40°), and southeastern Iowa, citing Keyes and Williams' Des Moines record (*supra*) as "Doubtful."

ERRATA.

Page 135, footnote 1, read Auk for Aux.
Page 174, line 37, read gemmæ for bemmæ.
Page 175, line 2, read greater Scaup for great Scaup.
Page 181, line 2, read *jamaicensis* for *rubida*.
Page 183, line 23, read *nivalis* for *nivatis*.
Page 193, line 26, after Osborn insert who.
Page 207, line 10, read Giddings for Giddinger.
Page 220, line 17, read *arenaria* for *aredaria*.
Page 251, line 24, read ASTURINA for ASTURNIA.
Page 251, line 25, read *Asturina* for *Asturnia*.
Page 252, line 13, read *Archibuteo* for *Archibutea*.
Page 252, line 13, read Ferruginous for Ferrugineous.
Page 252, line 15, read Ferruginous for Ferrugineous.
Page 258, line 11, read *haliaëtus* for *haliætus*.
Page 261, line 7, read *varium* for *vorium*.
Page 262, line 9, read *acadica* for *æcadica*.
Page 268, line 13, insert quotation marks before 4th word.
Page 273, line 28, read Woodpecker for Woodpeckers.
Page 282, line 26, read viscid for vascid.
Page 293, line 8, read Oberholser for Oberholzer.
Page 312, line 3, read Cabanis for Cab.
Page 320, line 21, read *Fringilla* for *Fringille*.
Page 333, line 16, read *lunifrons* for *ludifrons*.
Page 335, line 19, read RIPARIA Forster for CLIVICOLA Forster.
Page 335, line 20, read *Riparia* for *Clivicola*.
Page 357, after 2nd line insert 310. (672). *Dendroica palmarum*. See Addenda, page 404.
Page 357, line 3, read 311. (673). for 310. (672).
Page 360, line 2, read May 21 for May 1.
Page 370, line 31, read CISTOTHORUS for CISTOTHOROUS.
Page 390, line 32, read *Cistothorus* for *Cistothorous*.
Page 373, line 27, read Merriam for Merrian.
Page 373, line 29, read Chickadees for Chicadees.
Page 379, line 35, read *swainsoni* for *swainson*.
Page 387, after line 23, insert Family CATHARTIDÆ.
Page 391, line 16, read Willow for Wilson.
Page 392, line 15, read number for numbers.

INDEX

PAGE

Acanthis linaria 311
hornemanni exilipes..... 388
rostrata..... 311
Accipiter atricapillus..... 246
cooperi..... 245
velox..... 244
Accipitrinæ..... 242
Actitis macularia..... 225
Actodromas bairdi..... 218
fuscicollis..... 217
maculata 217
minutilla 218
Addenda..... 404
Æchmophorus occidentalis..... 148
Ægialitis meloda..... 229
meloda circumcincta 230
semipalmata 229
Agelæinæ. 298
Agelaius phœniceus..... 300
phœniceus fortis 301
Agriculture, relation to..... 133
Aix sponsa 172
Alandidæ 291
Alcidæ 152
Alcinæ 152
Alcedinidæ 272
Alcyones 272
Ammodramus henslowi 317
henslowi occidentalis 388
lecontei 318
nelsoni 310
Ampelidæ 336
Ampelinæ 336
Ampelis cedrorum 337
garrulus 336
Anas boschas 166
obscura 167
obscura rubripes 167
Anatidæ 163 386
Anatinæ 165
Anhinga anhinga 160
Anhingidæ 160
Anser albifrons gambeli 184
Anseres 163
Anserinæ..... 181
Anthus pensilvanicus 364
spraguei..... 365
Antrostomus vociferus 280
Aphrizidæ..... 230
Appendix, Bibliographical..... 393

PAGE

Aquila chrysaëtos 253
Archibuteo ferrugineus..... 252
lagopus sancti-johannis..... 251
Ardea herodius 196
Ardeidæ 194
Ardeinæ..... 196
Ardetta exilis..... 195
Areas, Faunal 141
Arenaria marinella..... 230
Arquatilla maritima..... 387
Asio accipitrinus..... 260
magellanicus occidentalis.... 265
magellanicus wapacuthu 265
wilsonianus..... 259
Astragalinus tristis..... 312
Astur 246
Asturina plagiata 251
Auks... 152
Avocet, American.... 213
Aythya affinis..... 175
americana 173
collaris..... 176
marila..... 175
vallisneria 174

B

Bæolophus bicolor 374
Baldpate 168
Bartramia longicauda 224
Bibliography 393
Bittern, American..... 194
Least..... 195
Blackbird, Brewer 306
Northern Red-winged..... 301
Red-winged..... 300
Rusty 306
Thick-billed 301
Yellow-headed..... 300
Bluebird 382
Chestnut-backed..... 383
Mountain 392
Bobolink 298
Bobwhite..... 231
Bonasa umbellus..... 232
Botaurinæ..... 194
Botaurus lentiginosus..... 194
Brant..... 184 189
Branta bernicla glaucogastra..... 189
canadensis..... 185
canadensis hutchinsii..... 187

Branta canadensis minima..... 188
Bubonidæ.....259 387
Bubo virginianus..... 263
virginianus arcticus.....265 266
virginianus pallescens..... 265
virginianus subarcticus..... 265
Bufflehead..... 177
Bunting, Black-throated..... 329
Indigo..... 329
Lark..... 330
Snow..... 313
Buteo borealis..... 246
borealis calurus..... 248
borealis harlani..... 248
borealis krideri..... 247
lineatus..... 249
platypterus..... 251
swainsoni..... 250
Butorides virescens..... 199
Buzzard, Turkey..... 241

C

Calamospiza melanocorys..... 320
Calcarius lapponicus..... 313
ornatus..... 314
pictus..... 313
Calidris arenaria..... 220
Callipepla squamata..... 232
Canvasback..... 174
Caprimulgi..... 278
Caprimulgidæ..... 278
Cardinal..... 327
Cardinalis cardinalis..... 327
Carinatæ..... 148
Carpodacus purpureus..... 309
Catbird..... 366
Cathartes aura..... 241
urubu..... 387
Cathartidæ..... 241
Centronyx bairdi..... 316
Centurus carolinus..... 277
Ceophlœus pileatus abieticola.... 276
Cepphi..... 151
Certhia familiaris americana..... 372
Certhiidæ..... 372
Ceryle alcyon..... 272
Chætura pelagica..... 282
Chæturinæ..... 282
Charadridæ..... 227
Charadrius dominicus..... 227
Charitonetta albeola..... 177
Chat, Yellow-breasted..... 362
Chaulelasmus streperus..... 168
Chen cærulescens..... 184
hyperborea..... 181
hyperborea nivalis..... 183
Chewink..... 389
Chickadee..... 374
Chickadee, Carolina..... 375
Long-tailed.....3 75
Chicken, Pintail..... 236
Prairie..... 233
Chondestes grammacus..... 319
grammacus strigatus..... 319
Chordeiles virginianus..... 280
virginianus henryi..... 281
virginianus sennetti..... 281
Ciconidæ..... 386
Circus hudsonius..... 244
Cistothorus stellaris..... 370
Clamatores..... 284
Clangula clangula americana..... 176
islandica..... 177
Clivicola (Riparia) riparia..... 335
Coccyges..... 271
Coccyzinæ..... 271
Coccyzus americanus..... 271
erythrophthalmus..... 272
Colaptes auratus luteus..... 278
cafer collaris..... 279
Colinus virginianus..... 231
Columbæ..... 238
Columbidæ..... 238
Columbinæ..... 239
Colymbus auritus..... 149
holbœlli..... 148
nigricollis californicus..... 149
Compsothlypis americana ramalinæ..... 350
Contopus richardsoni..... 388
virens..... 287
Contributors..... 144
Conurus carolinensis..... 269
Coot..... 210
Cormorant, Double-crested..... 161
Corvidæ..... 293
Corvus brachyrhynchos..... 296
corax principalis..... 296
corax sinuatus..... 295
Coturnicops..... 208
Coturniculus savannarum bimaculatus..... 316
savannarum passerinus..... 316
Cowbird..... 299
Crane, Little Brown..... 204
Sandhill..... 205
Whooping..... 201
Creciscus..... 209
Creeper, Brown..... 272
Crossbill, American..... 309
White-winged..... 310
Crow, American..... 294
Crymophilus fulicarius..... 211
Cryptoglaux acadica..... 262
tengmalmi richardsoni..... 387
Cuckoo, Black-billed..... 272

Cuckoo, Yellow-billed 271
Cuculi 271
Cuculidæ 271
Curlew, Eskimo 227
Hudsonian 226
Long-billed 225
Cyanocitta cristata 295
Cyanospiza cyanea 329
Cygninæ 190
Cypseli 282

D

Dafila acuta 171
Dendroica æstiva 351
blackburniæ 355
cærulescens 352
castanea 354
cerulea 353
coronata 352
discolor 357
dominica 355
dominica albilora 355
kirtlandi 390
maculosa 352
pensylvanica 353
palmarum 405
striata 354
tigrina 350
vigorsi 356
virens 356
Dickcissel 329
Dolichonyx oryzivorus 298
Dove, Mourning 240
Doves 238
Dowitcher 216
Long-billed 216
Dryobates pubescens medianus 274
villosus 273
villosus leucomelas 274
Duck, American Eider 178
American Golden-eye 176
Baldpate 168
Barrow Golden-eye 176
Black 167
Blackhead 175
Bluebill 175
Bufflehead 177
Canvasback 174
Fish 163
Gray 168
Greater Scaup 175
Harlequin 178
King Eider 179
Lesser Scaup 175
Mallard 166
Old-squaw 177
Pintail 171
Redhead 173
Duck, Ring-billed 176
Ring-necked 176
Ruddy 181
Scaup 175
Shoveller 171
Spoonbill 171
Summer 172
Wood 172

E

Eagle, Bald 253
Golden 254
Economic Value 133 134
Ectopistes migratorius 239
Egret, American 197
Egretta candidissima 197
Eider, American 178
King 179
Elanoides forficatus 242
Empidonax flaviventris 287
minimus 290
trailli 289
trailli alnorum 290
virescens 288
Ereunetes occidentalis 220
pusillus 219
Erismatura jamaicensis (rubida) 181
Eritonetta 179
Errata 407
Euphagus carolinus 306
cyanocephalus 306
Extinct species 269 392

F

Falco columbarius 256
mexicanus 254
peregrinus anatum 255
richardsoni 251
sparverius 257
Falcon, Peregrine 255
Prairie 254
Falcones 242
Falconidæ 242
Falconinæ 254
Finch, Grass 315
Purple 309
Flicker, North'n (Yellow-shafted) 278
Red-shafted 279
Florida cærulea 198
Flycatcher, Acadian 288
Alder 290
Crested 285
Green-crested 288
Least 290
Olive-sided 287
Traill 289
Yellow-bellied 287
Food 133

Fregata aquila 163
Fregatidæ 163
Frigate Bird 163
Fringillidæ ..... 307 388.
Fulica americana 210
Fulicinæ 210
Fuligulinæ 173
Fulix marila 175

G

Gadwall 168
Galeoscoptes carolinensis 215
Gallinago delicata 215
Gallinula galeata 210
Gallinule, Florida 210
Purple 209
Gallinulinæ 209
Garrulinæ 294
Gavia arctica 151
imber 151
lumme 152
Gaviidæ 151
Gelochelidon nilotica 386
Geothlypis agilis 360
formosa 359
philadelphia 360
trichas 361
trichas brachidactyla 361
trichas occidentalis 361
Gnatcatcher, Blue-gray 377
Goatsuckers 279
Godwit, Hudsonian 221
Marbled 220
Golden-eye, American 176
Barrow (Rocky Mountain) ... 177
Goldfinch, American 312
Goose, Blue 184
Cackling 188
Canada 185
Emperor 386
Greater Snow 183
Hutchins 187
Lesser Snow 181
White-fronted 184
Goshawk, American 246
Mexican 251
Grackle, Bronzed 307
Grebe, American Eared 149
Holbœll 148
Horned 149
Pied-bellied 150
Western 148
Grosbeak, Black-headed 389
Blue 390
Evening 308
American Pine 308
Rose-breasted 328
Western Blue 390
Grouse, Pinnated 233
Prairie Sharp-tailed 236
Grouse, Ruffed 232
Grues 201
Gruidæ 201
Grus americana 201
canadensis 204
mexicana 205
Guara alba 386
Guiraca cærulea lazula 390
Gull, Bonaparte 156
Franklin 155
Great Black-backed 385
Herring 154
Kittiwake 385
Laughing 155
Ring-bellied 154
Sabine 156
"Slough" 159

H

Haliæetus leucocephalus 253
Harelda hyemalis 177
Hawk, American Rough-legged .. 251
Black 248
Broad-winged 251
Cooper 245
Duck 255
Ferruginous Rough-legged .. 252
Fish 258
Harlan 248
Harris 246
Krider 247
Marsh 244
Pigeon 256
Red-shouldered 249
Red-tailed 246
Sharp-shinned 244
Sparrow 257
Swainson 250
Western Red-tailed 248
Helmintheros vermivorus 347
Helminthophila celata 349
chrysoptera 348
peregrina 349
pinus 347
rubricapilla 349
Helodromas solitarius 222
Hen, Marsh 206
Prairie 233
Herodias egretta 197
Herodii 194
Herodiones 192
Heron, Black-crowned Night 199
Great Blue 196
Green 199
Little Blue 198
Snowy 197

Heron, Yellow-crowned Night ... 200
Hesperiphona vespertina 308
Hierofalco 254
Himantopus mexicanus 214
Hirundinidæ 332
Hirundo erythrogastra 334
Historical Work, Iowa 128
Histrionicus histrionicus 178
Horticulture, Relation to 133
Hummingbird, Ruby-throated ... 283
Hydrochelidon nigra surinamensis 159
Hylocichla aliciæ 379
aonalaschkæ pallasi 380
fuscescens 378
fuscescens salicicolus 391
mustelina 378
ustulata almæ 391
ustulata swainsoni 379
Hypothetical List 384

I

Ibides 192
Ibididæ 192 386
Ibis, Glossy 193
White 386
White-faced Glossy 193
Wood 386
Icteria virens 362
Icteridæ 305
Icterinæ 305
Icterus galbula 305
spurius 305
Ictinea mississippiensis 243
Introduced Species 384
Introduction 128
Ionornis martinica 209
Iowa, Climatology of 139
Geological formation of 138
Map of ..... facing 125
Physiography of 138
Topography of 137
Iridoprocne bicolor 334

J

Jæger, Parasitie 153
Jay, Blue 295
Junco hyemalis 324
Montana 324
montanus 324
Pink-sided 325
Slate-colored 324
shufeldti 324

K

Killdeer 228
Kingbird 284
Arkansas 285
Kinglet, Golden-crowned 376
Kinglet, Ruby-crowned 376
Kite, Mississippi 243
Kite, Swallow-tailed 242
Kittiwake 385
Knot 387

L

Laniidæ 338
Lanius borealis 338
ludovicianus excubitorides ... 338
ludovicianus migrans 339
Lanivireo 342
Laridæ 154 385
Larinæ 154
Lark, Desert Horned 293
Horned 293
Hoyt Horned 292
Prairie Horned 292
Larus argentatus 154
atricilla 155
delawarensis 154
franklini 155
marinus 385
philadelphia 156
Leucosticte, Gray-crowned 311
tephrocotis 311
Limicolæ 211
Limosa fedoa 220
hæmastica 221
Longipennes 153
Longspur, Chestnut-collared 314
Lapland 313
McCown 314
Smith 313
Loon 151
Black-throated 151
Red-throated 152
Lophodytes cucullatus 164
Loxia curvirostra minor 309
leucoptera 310

M

Macrochires 279
Macrorhamphus griseus 216
scolopaceus 216
Magpie 294
Mallard 166
Man-o'-war Bird 163
Mareca americana 168
Martin, Purple 332
Meadowlark 302
Western 303
Megascops asio 262
Melanerpes erythrocephalus 276
Melanitta 179
Meleagrinæ 237
Meleagris gallopavo silvestris ... 237
Melospiza cinerea melodia 325

Melospiza georgiana..... 326
lincolni. 325
Merganser, American. 164
americana 164
Hooded 164
Red-breasted..... 164
serrator..... 164
Merginæ 163
Merlin, Richardson 257
Merula migratoria. 380
Micropalama himantopus 217
Micropodidæ 282
Migration 134
Migration Routes 135
Mimidæ 365
Miminæ. 365
Mimus polyglottos..... 365
Mniotilta varia 344
Mniotiltidae 344 390
Mockingbird. 365
Moluthrus ater..... 299
Motacillidæ 364
Murre, Brünnich..... 152
Myadestes townsendi..... 301
Myiarchus crinitus..... 285

N

Neocorys 365
Nettion carolinensis..... 169
crecca 386
Nighthawk 280
Sennett..... 281
Western..... 281
Nucifraga columbiana..... 297
Numeninæ 225
Numenius borealis..... 227
hudsonicus 226
longirostris 225
Nutcracker, Clarke..... 297
Nuthatch, Red-breasted 373
White-breasted..... 373
Nuttallornis borealis 287
Nyctanassa violacea 200
Nyctea nyctea 266
Nycticorax nycticorax nævius.. 199

O

Oidemia americana..... 179
deglandi. 179
perspicillata 180
Olbiorchilus hiemalis..... 370
Old-squaw..... 177
Olor buccinator 191
columbianus 190
Oporornis. 359
Oriole, Baltimore..... 305
Orchard 305
Oscines..... 291
Osprey, American..... 258
Otocoris alpestris alpestris..... 291
alpestris hoyti 292
alpestris leucolæma 293
alpestris praticola..... 292
Ovenbird 357
Owl, American Hawk 267
Arctic Horned 265 266
Barn 258
Barred..... 261
Burrowing. 268
Great Gray 261
Great Horned..... 263
Long-eared 259
Richardson..... 387
Saw-whet..... 262
Screech..... 262
Short-eared..... 260
Snowy..... 266
Western Horned..... 265
Oxyechus vociferus..... 228

P

Paludicolæ 201
Pandion haliaëtus carolinensis... 258
Parabuteo unicinctus harrisi..... 246
Paridæ 373
Parinæ 374
Paroquet, Carolina 269
Partridge..... 232
Scaled..... 232
Parus atricapillus 374
atricapillus septentrionalis... 375
carolinus 375
Passerculus sandwichensis savanna 315
Passer domesticus..... 384
Passerella iliaca..... 326
Passerina nivalis..... 313
Pediocætes phasianellus campestris..... 236
Pelecanidæ 161
Pelecanus erythrorhynchos 162
fuscus..... 163
occidentalis..... 163
Pelican, Brown..... 163
White..... 162
Pelidna alpina sakhalina..... 219
Pelionetta 180
Pendulinus 305
Perdicinæ 231
Petrochelidon lunifrons..... 331
Peucæa æstivalis bachmannii.... 405
Pewee..... 286
Say 286
Wood 287
Western Wood..... 388
Phalænoptilus nuttalli. 404

Phalacrocoracidæ 161
Phalacrocorax dilophus.... 161
Phalarope, Northern 212
Red 211
Wilson 213
Phalaropodidæ.... 211
Phalaropus lobatus.... 212
Phasiani.... 231
Phasianidæ.. 237
Philacte canagica 386
Philohela minor.... 214
Phœbe 286
Say 286
Pica pica hudsonica 294
Pici 273
Picidæ 273
Picoides arcticus.... 274
Pigeon, Passenger.... 239
Pigeons.... 238
Pinicola enucleator canadensis... 308
Pintail.... 171
Pipilo erythrophthalmus.....326 389
maculatus arcticus 389
Pipit, American 364
Sprague 365
Piranga erythromelas.... 331
ludoviciana 390
rubra. 331
Plegadis autumnalis.... 193
guarauna 193
Plover, American Golden 227
Belted Piping.... 230
Black-bellied.... 227
Killdeer 228
Piping.... 229
Semipalmated. 229
Podicipidæ 148
Podicipides.... 148
Podilymbus podiceps.... 150
Polioptila cærulea.... 377
Polioptilinæ 377
Poocætes gramineus. 315
gramineus confinis.... 315
Poorwill.... 404
Porzana carolina 207
jamaicensis.... 209
noveboracensis.... 208
Prairie Hen.... 233
Progne subis.... 332
Protonotaria citrea 345
Psittaci.... 269
Psittacidæ.... 269
Pygopodes.... 148

Q

Quail.... 237
Querquedula cyanoptera.... 170
discors.... 169
Quiscalinæ 306
Quisculus quiscula æneus.... 307

R

Rail, Black.... 209
Carolina.... 207
King.... 206
Sora. 207
Virginia.... 207
Yellow 208
Ralli 206
Rallidæ 206
Rallinæ 206
Rallus elegans 206
virginianus 207
Range of Species.... 137
Raptores.... 241
Raven, American.... 295
Northern.... 296
Recurvirostra americana.... 213
Recurvirostridæ.... 213
Redhead.... 173
Redpoll 311
Greater.... 311
Hoary.... 388
Redstart, American 363
Red-tail 246
Western 248
Regulinæ.... 246
Regulus calendula.... 376
satrapa 376
Rhynchophanes macowni.... 314
Riparia (Clivicola) riparia 335
Rissa tridactyla.... 385
Robin, American.... 380
Rough-leg, American.... 251
Ferruginous 252

S

Salpinctes obsoletus.... 367
Sanderling.... 220
Sandpiper, Baird.... 218
Bartramian 224
Buff-breasted 225
Least.... 218
Pectoral 212
Red-breasted. 219
Semi-palmated 219
Solitary 222
Spotted.... 225
Stilt.... 217
Upland.... 224
Western Semi-palmated 220
Sapsucker, Yellow-bellied.... 275
Sarcorhamphi.... 241
Sawbill.... 163
Sayornis phœbe.... 286
saya.... 286

Scaup, Greater 175
Lesser 175
Scolopacidæ 214 386
Scolopacinæ 214
Scoter, American 179
Surf 180
White-winged 179
Scotiaptex nebulosa 261
Seiurus aurocapillus 357
motacilla 358
novoboracensis notabilis 359
Setophaga ruticilla 363
Shoveller 171
Shrike, Northern 338
Migrant 339
Northern Loggerhead 339
White-rumped 338
Sialia arctica 392
mexicana bairdi 383
sialis 382
Siskin, Pine 312
Sitta canadensis 373
carolinensis 373
Sittidæ 372
Snipe, Wilson 215
Jack 215 217
Snowbird 324
Snowflake 313
Solitaire, Townsend 391
Somateria dresseri 178
spectabilis 179
Sora 207
Sparrow, Bachman 405
Baird 316
Black-hooded 320
Chipping 322
Clay-colored 323
English 384
Field 324
Fox 326
Gambel 321
Golden-crowned 389
Grasshopper 316
Harris 320
Henslow 317
Intermediate 321
Lark 319
Leconte 318
Lincoln 325
Nelson 318
Savanna 315
Song 319
Swamp 326
Tree 322
Vesper 315
Western Grasshopper 316
Western Henslow 388
Western Lark 319
Sparrow, White-crowned 321
White-throated 332
Spatula clypeata 171
Sphyrapicus varuis 275
Speotyto cunicularia hypogæa 268
Spinus pinus 312
Spiza americana 329
Spizella monticola 322
pallida 323
pusilla 324
socialis 322
Squatarola squatarola 227
Steganopodes 160
Steganopus tricolor 212
Stelgidopteryx serripennis 336
Stercoriidæ 153
Stercorarius parasiticus 153
Sterna antillarum 158
caspia 156
forsteri 157
hirundo 158
Sterninæ 156
Stilt, Black-necked 214
Streptoceryle 272
Striges 258
Strigidæ 258
Strix pratincola 258
Sturnella magna 302
magna neglecta 302
Sturnellinæ 302
Summary 392
Surnia ulula caparoch 267
Swallow, Bank 335
Barn 334
Cliff 333
Rough-winged 335
Tree 334
White-bellied 334
Swan, Trumpeter 191
Whistling 190
Swift, Chimney 282
Sylviidæ 376
Symphemia semipalmata 223
semipalmata inornata 223
Synium varium 261

T

Tachytriorchis 250
Tanager, Louisiana 390
Scarlet 331
Summer 331
Tanagridæ 331 390
Tantalus loculator 386
Teal, Blue-winged 160
Cinnamon 170
European 386
Green-winged 169
Telmatodytes palustris iliacus 371

Tern, Black 159
Caspian 156
Common 158
Forster 157
Gull-billed 386
Least 158
Tetraonidæ 231
Tetraoninæ 232
Thrasher, Brown 367
Thrush, Alice 379
Alma 391
Gray-cheeked 379
Hermit 380
Olive-backed 379
Willow 391
Wilson 378
Wood 378
Thryomanes bewicki 368
Thryothorus ludovicianus 368
Tinnunculus 256
Titmouse, Tufted 374
Totanus flavipes 222
melanolencus 221
Towhee 326
Arctic 389
Toxostoma rufum 367
Tringa canutus 387
Tringinæ 216
Trochili 283
Trochilidæ 283
Trochilus colubris 283
Troglodytes aëdon aztecus 369
aëdon parkmani 369
Troglodytinæ 367
Tryngites subruficollis 225
Turdidæ 377 391
Turdinæ 378
Turkey, Wild 237
Turnstone, Ruddy 230
Tympanuchus americanus 233
Tyrannidæ 284 389
Tyrannus tyrannus 284
verticalis 285

U

Uria lomvia 152
troile 153

V

Vireo belli 343
Bell 343
Blue-headed 342
flavifrons 342
gilvus 341
noveboracensis 343
olivaceus 340
Philadelphia 341
philadelphicus 341
Vireo, Red-eyed 340
solitarius 342
Solitary 342
Warbling 341
White-eyed 343
Yellow-throated 342
Vireonidæ 340
Vireosylva 340
Vulture, Black 241
Turkey 387

W

Wagtails 364
Warbler, Bay-breasted 354
Blackburnian 355
Black-poll 354
Black-throated Blue 352
Black-throated Green 356
Blue-winged 347
Black and White 344
Canadian 363
Cape May 350
Cerulean 353
Chestnut-sided 353
Connecticut 360
Golden-winged 348
Hooded 362
Kentucky 359
Kirtland 390
Magnolia 352
Mourning 360
Myrtle 352
Nashville 349
Northern Parula 350
Orange-crowned 349
Orange-throated 355
Palm 405
Parula 350
Pine 356
Prairie 357
Prothonotary 345
Sycamore 355
Tennessee 349
Western Parula 350
Wilson 363
Worm-eating 347
Yellow 351
Yellow-throated 355
Water-Thrush, Grinnell 358
Louisiana 359
Waxwing, Bohemian 336
Cedar 337
Whippoorwill 280
Widgeon, American 168
Willet 223
Western 223
Wilsonia canadensis 363
mitrata 362

Wilsonia pusilla. 363
Woodcock.. 214
Woodpecker, Arctic Three-toed.. 274
Golden-winged. 278
Hairy 273
Northern Downy. 274
Northern Hairy 274
Northern Pileated. 276
Red-bellied... 277
Red-headed. 276
Wren, Bewick 368
Carolina 368
House 369
Long-billed Marsh 371
Prairie Marsh. 371
Rock 367
Short-billed Marsh 370
Western House. 369
Winter 370

X

Xanthocephalus xanthocephalus. 300
Xema sabinii 156

Y

Yellow-legs, Greater. 222
Lesser..... .. 221
Yellow-throat, Maryland 361
Northern..... 361
Western.... 361
Yphantes..... 305

Z

Zamelodia ludoviciana. 328
melanocephala..... 389
Zenaidinæ..... 240
Zenaidura macroura..... 240
Zones, Life..... 141
Zonotrichia albicollis..... 322
coronata..... 389
leucophrys..... 321
leucophrys gambeli 321
querula..... 320

ERRATA.

Page 144, line 3, read Long-tailed for Long-billed.
Page 282, line 33, read Charles R. Keyes for Charles P. Keyes.
Page 379, line 35, read *swainsoni* for *swainson*.
Page 401, line 22, read Birds of the Western United States.
Page 405, line 34, read page 357 for 337.

PUBLICATIONS OF THE DAVENPORT ACADEMY OF SCIENCES.

The Davenport Academy of Sciences commenced the publication of its PROCEEDINGS in 1876. The first ten volumes, together with such separate papers as are not out of print, are for sale, postpaid, at the prices affixed in the following list. Beginning with Volume XI, the PROCEEDINGS will be issued in the form of separate papers, to be distributed as soon as printed.

VOLUME I. Proceedings, 1867-1876. 8vo. 304 pp., 38 plates, 3 text figures. A limited number on hand. Paper, $5.00; cloth, $6.00.

VOLUME II. Proceedings, 1876-1878. 8vo. 364 pp., 13 plates, 24 text figures. Paper, $4.00; cloth, $5.00.

Also the following separates:

Gass, Rev. J.—Explorations of Mound No. 3, Cook's Farm Group. Farquharson, R. J.—On the Inscribed Tablets. 23 pp., 3 plates, 40 cents.

Putnam, J. Duncan—Biological and Other Notes on Coccidæ. I. Pulvinaria innumerabilis. II. Aspidiotus ancylus. 54 pp., 2 plates, 60 cents.

VOLUME III. Proceedings, 1879-1881. 8vo. 314 pp., portrait, 10 plates, 4 text figures. A limited number on hand. Paper, $4.00; cloth, $5.00.

Also separately:

Part 3, Memorial of J. Duncan Putnam, containing his Biography, by Dr. C. C. Parry, and The Sulpugidæ of America, by J. Duncan Putnam. 119 pp., portrait, 4 plates, $2.00.

VOLUME IV. Proceedings, 1882-1884. 8vo., 348 pp., portrait, 5 plates, 111 text figures. Paper, $3.00; cloth, $3.50.

Also the following separate:

Putnam, Charles E.—Elephant Pipes and Inscribed Tablets in the Museum of the Academy. 95 pp., 3 text figures, $1.00.

VOLUME V. Proceedings, 1885-1899. 8vo., 370 pp., portrait, 2 plates, text figures. Paper, $3.00; cloth, $3.50.

Also the following separates:

Call, R. E., and Pilsbry H. A.—On Pyrgulopsis, a New Genus of Rissoid Mollusk, 6 pp., 1 text figure, 1 plate, 20 cents.

Barris, W. H.—A Defense of Our Local Geology. 8 pp., 20 cents.

McGee, W J—Index to Proceedings, Volumes I-V. 89 pages.

VOLUME VI. Proceedings, 1889-1896. 8vo., 392 pp., portrait, 6 plates, 28 text figures. Paper, $3.00; cloth, $3.50.

Also the following separates:

Starr, Frederick.—Bibliography of Iowa Antiquities. 24 pp., 30 cents.

Parry, Charles Christopher, Biographical Sketch of, by C. H. Preston, M. D., together with a list of papers published by Dr. C. C. Parry, prepared by Mrs. C. C. Parry. 17 pp., portrait, 20 cents.

Starr, Frederick.—Summary of the Archæology of Iowa. 71 pp., 24 text figures, 75 cents.

McNeill, Jerome.—Revision of the Truxalinæ of North America. 95 pp., 5 plates, $1.25.

VOLUME VII. Proceedings, 1897-1898. 8vo., 316 pp., portrait, 17 plates, 4 text figures. Paper, $3.00; cloth, $3.50.

Also the following separates:

Putnam, Charles Edwin, A Memoir, by W. C. Putnam. 13 pp., portrait, 20 cents.

Barris, W. H.—Our Local Geology. 19 pp, 20 cents.

Osborn, Herbert and Ball, Elmer D.—Studies of North American Jassoidea. 55 pp., 6 plates, 75 cents.

Starr, Frederick.—Notched Bones from Mexico. A Shell Inscription from Tula, Mexico. 10 pp., 3 text figures, 1 plate, 20 cents.

Osborn, Herbert and Ball, Elmer D.—The Genus Pediopsis. A Review of the North American Species of Idiocerus. 27 pp., 30 cents.

Cockerell, T. D. A.—Contributions to the Entomology of New Mexico. 17 pp., 20 cents.

Scudder, Samuel H.—Supplement to a Revision of the Melanopli. 48 pp., 3 plates, 65 cents.

Wickham, H. F.—Habits of American Cicindelidæ. 22 pp., 25 cents.

Pammel, L. H.—Notes on Grasses of Nebraska, South Dakota and Wyoming. Hume, H. Harold.—Fungi collected in Colorado, Wyoming and Nebraska. 28 pp., 8 plates, 45 cents.

VOLUME VIII. Proceedings, 1899-1900. 8vo., 334 pp., portrait, 2 plates, 73 text figures. Paper, $3.00; cloth, $3.50.

Also the following separates:

Pratt, William Henry, A Biographical Sketch, by C. H. Preston. Pratt, W. H.—A Glimpse Into Our Future. 16 pp., 20 cents.

Scudder, Samuel H.—Catalogue of the Described Orthoptera of the United States and Canada. 100 pp., 3 plates, $1.25.

Starr, Frederick.—Notes Upon the Ethnography of Southern Mexico. (See also Vol. IX.) 90 pp., 10 plates, $1.10.

Barnes, W. D., Reppert, Fred and Miller, A. A.—The Flora of Scott and Muscatine Counties, Iowa. 85 pp., 2 plates, $1.00.

Putnam, Mrs. M. L. D.—Inaugural Address, read before the Academy April 27, 1900. 8 pp., 20 cents.

VOLUME IX. Proceedings, 1901-1903. 8vo., xv+337 pp., portrait, 34 plates, 6 text figures. Paper, $3.00; cloth, $3.50.

Also the following separates:

Scudder, Samuel H., and Cockerell, T. D. A.—A First List of the Orthoptera of New Mexico. 62 pp., 80 cents.

Starr, Frederick.—Notes upon the Ethnography of Southern Mexico. Part II. (See also Vol. VIII.) 102 pp., 3 figures, 9 plates, $1.25.

Shimek, B.—Helicina occulta, *Say*. 8 pp., 20 cents.

Starr, Frederick.—More Notched Bone Rattles. 3 pp., 3 figures, 10 cents.

Pergande, Theo.—North American Phylloxerinæ Affecting Hicoria (Carya) and Other Trees. 88 pp., 21 plates, $1.50.

VOLUME X. Proceedings, 1904-1905. Mary L. D. Putnam Memorial Volume. 8vo. Subscription price, $3.00. [*In press.*]

Also the following separates:

Putnam, Mrs. Mary Louisa Duncan, and Putnam, William Clement, Memoirs, by Elizabeth Duncan Putnam. 58 pp., 2 portraits, 2 plates, 75 cents.

Jordon, David Starr and Seale, Alfred.—List of Fishes Collected at Hong Kong by Captain William Finch, with Description of Five New Species. 17 pages, 18 plates, two of them colored, 60 cents.

Calvin, Samuel.—The Aftonian Gravels and Their Relation to the Drift Sheets in the Region about Afton Junction and Thayer. 12 pp., 7 plates, 30 cents.

Pammel, L. H.—A Comparative Study of the Vegetation of Swamp, Clay, and Sandstone Areas in Wisconsin, Southeastern Minnesota, Northeastern, Central and Southeastern Iowa. 94 pp., 42 figures, $1.10.

Cockerell, T. D. A.—Some Coccidæ from the Philippine Islands. 10 pp., 20 cents.

Osten Sacken, C. R.—The Common Drone-fly (Eristalis tenax, *Linn.*). 4 pp., 10 cents.

Fewkes, J. Walter.—Mural Relief Figures on a Mexican Ruin. 7 pp., 6 plates, 25 cents.

Macbride, Thomas V.—On Certain Fossil Plant Remains in the Iowa Herbarium. 10 pp., 12 plates, 35 cents.

Osborn, Herbert.—Descriptions of New Forms of Jassidæ. 4 pp., 10c.

Nutting, C. C.—On Local Museums. 10 pp., 20 cents.

VOLUME XI. Proceedings, 1906. 8vo.

Individual papers, issued separately as printed:

Edmondson, Charles Howard.—The Protozoa of Iowa. A Study of Species Known to Occur in the Waters of this State. 124 pp., 32 plates, $1.50.

Anderson, Rudolph Martin.—The Birds of Iowa. 293 pp., 1 map, $3.00.

VOLUME XII.

Moulton, Dudley.—The Monterey Pine Scale, Physokermes insignicola, *Craw.* [*In press*].

The Academy exchanges with learned societies and libraries.

Orders for publications of the Academy, whether for sets, volumes, or separate papers, should be addressed: "Davenport Academy of Sciences, Davenport, Iowa, U. S. A." Remittances, whether by draft or money order, should be made payable to "Treasurer, Davenport Academy of Sciences."

120
Io. 4.

SEPTEMBER, 1906 VOL. XI., PAGES 1-124

Proceedings

—OF THE—

Davenport Academy of Sciences

THE PROTOZOA OF IOWA

BY CHARLES HOWARD EDMONDSON

Published from the Income of the
Putnam Memorial Fund

DAVENPORT, IOWA, U. S. A.
DAVENPORT ACADEMY OF SCIENCES
1906

Beginning with Volume XI the Davenport Academy of Sciences will change the manner of publication of its PROCEEDINGS. To avoid the delay incident to waiting for volumes to be completed, and to make less likely the burying of valuable papers in a general volume, hereafter the separate papers will be distributed in pamphlet form as soon as printed. The last section of each volume will contain reports of officers and a record of the Academy meetings, together with title page for the volume, table of contents, and index. This plan will make possible the binding of the volumes of the PROCEEDINGS by those libraries and societies that wish to keep their file intact. On the other hand there will be a more prompt and direct distribution of the separate papers to those who are most interested.

THE PUBLICATION COMMITTEE

DAVENPORT, IOWA,
September, 1906.

RECEIVED
JUL 6 1907
PEABODY MUSEUM.

MARCH, 1907. VOL. XI. PAGES 125-417

Proceedings

—OF THE—

Davenport Academy of Sciences

THE BIRDS OF IOWA

BY RUDOLPH M. ANDERSON

DAVENPORT, IOWA, U. S. A.
DAVENPORT ACADEMY OF SCIENCES
1907

TOZZER LIBRARY
3 2044 042 048 256

This book should be returned to the Library on or before the last date stamped below.

Please return promptly.